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MENTAL ARITHMETIC,

BY

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PART I.

FUNDAMENTAL RULES, FRACTIONS,
ANALYSIS.

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PREFACE.

Mental Arithmetic is not intended to supersede written arithmetic, but should rather be its constant auxiliary. Without proper mental training, the pupil becomes accustomed to depend almost entirely on rules and formulæ—not capable of interpreting the latter, and entirely in the dark as to the reasons of the former. The long and barren reign of rule and routine is due to the fact that rational methods in teaching the **Logic of the Public School** have been too generally ignored—that Mental Arithmetic, which, by easy steps, leads the pupil into an intelligent possession of principles, and renders him expert and logical in their application, has hitherto held an utterly insignificant place in school-room work. Given a slate, a pencil, a rule, and a salutary dread of coming *trouble*, and a pupil was supposed to be *seized* of all the elements necessary to make him a first-rate arithmetician. But better methods have begun to prevail; and the improvement in teaching written arithmetic which has taken place during the past few years has only to be supplemented by *systematic* mental training, in order to reach the highest results of the study of the same. This is recognized by the various educational authorities throughout the Dominion. Most of them have, it is believed, made it imperative that their teachers shall have a thorough training in Mental Arithmetic, and prove by actual examination, their knowledge of rational methods as well as their ability to teach them.

In a very short time the wisdom of this course will be seen, not only in increased proficiency in mathematical science, but in consequently increased intelligence and power in mastering other subjects.

It is hoped that this work, undertaken at urgent request of many teachers and inspectors, will be found useful in suggesting the methods and affording the materials for thorough and systematic mental training. No formal rules nor definitions have been given—these can be given by the teacher when the pupil has been led by easy inductions to a clear comprehension of the ideas and principles they involve. A great variety of type questions on the fundamental rules, fractions, and analysis, has been given ; and the teacher can multiply at pleasure questions corresponding to the various types.

The **Second Part**, most of which is already written, will contain illustrations of concise methods of computation, ratio, and proportional parts, a full treatment of all the rules that come under the general head of percentage, and a large collection of examination papers for mental solution, affording examples of every variety of question likely to be met with in ordinary written arithmetic.

HINTS TO TEACHERS.

1. Use natural objects (numeral frame, etc.) to give first notions of numbers. First, teach carefully the analysis of elementary numbers (with their notation) up to *nine* inclusive—so as to give clear notions of addition, subtraction, multiplication and division.

2. In addition etc., let the pupil have plenty of drill in *small numbers*, till he thoroughly comprehends the elementary processes. *Types* of *easy* questions are given in the book—let similarly easy questions be framed by the teacher, and by the pupils for mutual drill.

3. Give many *practical* questions, so that ultimately when a problem is prepared the pupil will be able to know in an instant which of the fundamental rules, or what combination of them, is to be applied in the solution.

4. Always proceed from the known to the unknown. The pupil learns subtraction from his knowledge of *addition*, etc., etc.: knowing that $4 + 3 = 7$, he knows that $7 - 3 = 4$, and that $7 - 4 = 3$; knowing that $4 \times 3 = 12$, he knows that 12 contains 4, 3 times, and 3, 4 times, etc.

5. In the "simple rules," prepare the way for fractions; make young scholars familiar with *factors*, *multiples*, *measures*. The pupil having become thoroughly familiar by proper training in the simple rules, with the notion of *division* into equal *parts*, and with the language expres-

sing such division, will find but little difficulty in the whole subject of fractions.

6. In general, pupils should not be permitted to use a text-book during recitation—young pupils need no book; those who have advanced to division, analysis, etc., will do better to prepare assigned lessons, and at the same time, should have additional questions proposed corresponding to the given types.

7. In addition to daily oral work, there should be *frequent* written examinations; the pupils are furnished with pencils and small slips of paper; they are directed to turn to certain questions, to write down on their slips the numbers of these questions, and are then allowed a given time to solve them mentally, using the pencil only to write, opposite its number, the *answer* they have found for any question.

8. The pupil should commence mental arithmetic when he enters school, and should continue it so long as it is thought necessary that arithmetic should be one of his studies.

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CHAPTER I.

FUNDAMENTAL RULES.

Section I.—Addition.

EXAMPLES.—1.

1. Charlie had 2 cents, and he found 1 cent: how many had he then? 3

Ans.—2 cents and 1 cent are 3 cents.

2. John has 2 dollars, and his father gives him 3: how many has he now? 5

3. Harry had 2 marbles, and Charlie gave him 6: how many had he then? 8

4. Mary had 9 pins, and found 2: how many had she then? 11

5. Sarah paid 3 cents for a pen, and 8 cents for a holder: how much did she pay for both? 11

6. In a class are 9 boys and 5 girls: how many are there in all? 14

7. Mary paid 7 dollars for a dress, and 4 dollars for a bonnet: how much did she pay for both? 11

8. Harry shot 5 pigeons, and Willie 7: how many did both shoot? 12

9. How many are 2 and 1? 3 1 and 2? 3 2 and 2? 4 2 and 3? 5 3 and 2? 5 2 and 4? 6 4 and 2? 6 2 and 5? 7 5 and 2? 7 2 and 6? 6 and 2? 8 2 and 7? 9 7 and 2? 2 and 8? 10 8 and 2? 10 2 and 9? 11 9 and 2? 2 pence and 9 pence? 2 days and 9 days?

10. How many are 3 and 2? 2 and 3? 3 and 3? 3

and 4? 4 and 3? 3 and 5? 5 and 3? 3 and 6? 6 and 3? 3 and 7? 7 dollars and 3 dollars? 3 hours and 8 hours? 8 tons and 3 tons? 3 tons and 9 tons? 9 thousand and 3 thousand?

11. How many are 4 and 3? 3 and 4? 4 and 4? 4 and 5? 5 and 4? 4 men and 6 men? 6 boys and 4 boys? 4 yards and 7 yards? 7 inches and 4 inches? 4 tons and 8 tons? 8 tons and 4 tons? 4 hundred and 9 hundred? 9 hundred and 4 hundred?

12. A man paid 9 dollars for a coat and 5 dollars for a vest: what did both cost him?

13. James spends 6 cents in apples and 9 cents in oranges: how much does he spend in all?

14. A boy found 8 eggs in one nest and 9 in another: how many eggs did he find?

15. Willie caught 9 lobsters in the forenoon and 9 in the afternoon: how many did he catch in all?

16. How many are 6 cents and 8 cents? 6 dollars and 8 dollars? 6 dimes and 8 dimes? 6 shillings and 8 shillings? 6 pence and 8 pence? 8 farthings and 6 farthings? 8 pears and 6 pears? 8 tenths and 6 tenths? 8 thirds and 6 thirds?

17. How many are 5 and 4? 4 and 5? 5 and 5? 5 and 6? 6 and 5? 5 and 7? 7 and 5? 5 and 8? 8 and 5? 5 months and 9 months? 9 tens and 5 tens?

18. How many are 6 and 5? 5 and 6? 6 and 6? 6 and 7? 7 and 6? 6 and 8? 8 and 6? 6 and 9? 9 and 6?

19. How many are 7 and 6? 6 and 7? 7 and 7? 7 farthings and 8 farthings? 8 drams and 7 drams? 7 grains and 9 grains? 9 grains and 7 grains?

20. How many are 8 and 7? 7 and 8? 8 and 8? 8

and 9? 9 and 8? 9 fourths and 8 fourths? 8 tenths and 9 tenths?

21. How many are 9 and 6? 6 and 9? 9 and 7? 7 and 9? 9 and 8? 8 and 9? 9 and 9? 9 thousand and 8 thousand.

22. How many are 10 and 2? 10 and 3? 10 and 4? 10 and 5? 10 and 6? 10 and 7? 10 and 8? 10 and 9? 10 and 10?

23. A man travelled 9 miles by coach and 10 miles by rail: how far did he travel in all?

24. John caught 7 haddock and Edward 4 more than John: how many did both catch?

25. How many are 11 and 3? 13 and 3? 16 and 3? 22 and 3? 24 and 3? 12 and 5? 16 and 5? 18 and 5? 21 and 5?.

EXAMPLES.—2.

1. How many are 11 and 8? 13 and 8? 14 and 8? 18 and 8? 19 and 8? 21 and 8? 11 and 9? 12 and 9? 13 and 9? 15 and 9? 17 and 9? 19 and 9? 21 and 9?

2. How many are 2 and 2? 2 and 12? 2 and 22? 2 and 32? 2 and 42? 2 and 52? 2 and 62? 2 and 72? 2 and 82? 2 and 92? $2 and $92? 2 pence and 92 pence? 2 tens and 92 tens?

3. How many are 3 and 3? 3 and 13? 3 and 23? 3 and 33? 3 and 43? 3 and 53? 3 and 63? 3 and 73? 3 and 83? 3 and 93? 96 and 4?

4. How many are 4 and 4? 4 and 14? 4 and 24? 4 and 34? 4 and 44? 4 and 54? 4 and 64? 4 and 74? 4 and 84? 4 and 94? 98 and 2?

5. How many are 5 and 5? 5 and 15? 5 and 25? 5

and 35? 5 and 45? 5 and 55? 5 and 65? 5 cents and 75 cents? 5 pence and 85 pence? $5 and $95? 5 tens and 95 tens?

6. Susan paid 7 cents for needles, 10 cents for thread, and 9 cents for pins: how much did she spend?

7. A farmer paid 9 dollars for a harrow, and 19 dollars for a plough: how much did he pay for both?

8. George buys 9 marbles at one time, 6 at another, and 12 at another: how many does he buy in all?

9. A farmer sold 8 bushels of oats, 9 bushels of peas, and 9 bushels of rye: how many bushels in all did he sell?

10. The head of a fish is 6 inches long, the tail 9 inches, and the body 12 inches: find the length of the fish.

11. Harvey pays 5 dollars for a pair of boots, 17 dollars for a suit of clothes, and 4 dollars for a hat: what does he pay in all?

12. A man had 95 dollars in a savings bank, and deposited 5 dollars more: how much money had he then in bank?

13. How many are 6 and 6? 6 and 16? 6 and 26? 6 and 36? 6 and 46? 6 and 56? 6 and 66? £6 and £76? 6 and 86? $6 and $96?

14. How many are 7 and 7? 7 and 17? 7 and 27? 7 and 37? 7 and 47? 7 and 57? 7 and 67? 7 and 77? 7 and 87? 7 and 97?

15. How many are 8 and 8? 8 and 18? 8 and 28? 8 and 38? 8 and 48? 8 and 58? 8 and 68? 8 and 78? 8 and 88? 8 and 98?

16. How many are 9 and 9? 9 and 19? 9 and 29? 9 and 39? 9 and 49? 9 and 59? 9 and 69? 9 cents and 79 cents? 9 farthings and 89 farthings? $9 and $99? 9 tens and 99 tens.

17. How many are 10 and 11? 10 and 21? 10 and 31? 10 and 41? 10 and 51? 10 and 61? 10 and 71? 10 and 81? 10 and 91? 10 hundred and 91 hundred? 10 tenths and 91 tenths?

18. How many are 10 and 13? 10 and 22? 10 and 32? 10 and 42? 10 and 52? 10 and 62? 10 and 72? 10 and 82? 10 and 92?

19. I used 8 rolls of paper for a bed room, and 28 for a parlor: how many did I use for the two rooms?

20. A farmer has 7 acres in forest and 67 acres cleared: how many acres has he in all?

21. Herman's grandfather was 73 years old 8 years ago: how old is he now?

22. A man travelled 9 miles by stage and 89 by rail: how far did he travel?

23. A carter paid 10 dollars for a cart and 92 dollars for a horse: how much did he pay for both?

24. Jane paid 5 cents for ink, 7 cents for pens, and 92 cents for an arithmetic: how much did she pay out?

25. John gave his brother 5 cents, his sister 6 cents, and had 19 cents left: how much had he at first?

26. Richard had 9 marbles, and Harry and Thomas had together 79 marbles: how many had all three?

EXAMPLES.—3.

1. How many are 10 and 4? 10 and 14? 10 and 24? 10 and 34? 10 and 44? 10 and 54? 10 and 64? 10 and 74? 10 and 84? 10 and 94?

2. How many are 11 and 3? 11 and 23? 11 and 33? 11 and 43? 11 and 53? 11 and 63? 11 and 73? 11 cents and 83 cents? $11 and $93?

3. How many are 11 and 4? 11 and 14? 11 and 24?

11 and 34? 11 and 44? 11 and 54? 11 and 64? 11 and 74? 11 minutes and 84 minutes? 11 hours and 94 hours?

4. How many are 10 and 5? 10 and 15? 10 and 25? 10 and 35? 10 and 45? 10 and 55? 10 and 65? 10 and 75? 10 guineas and 85 guineas? £10 and £95?

5. How many are 11 and 5? 11 and 15? 11 and 25? 11 and 35? 11 and 45? 11 and 55? 11 and 65? 11 seconds and 75 seconds? 11 francs and 85 francs? 11 crowns and 95 crowns? 11 fourths and 95 fourths?

6. How many are 3 and 8? 3 and 18? 3 and 28? 3 and 38? 3 and 48? 3 and 58? 3 and 68? 3 and 78? 3 gallons and 88 gallons? 3 pints and 98 pints? 3 tens and 98 tens?

7. How many are 8 and 4? 8 and 14? 8 and 24? 8 and 34? 8 and 44? 8 and 54? 8 and 64? 8 and 74? 8 and 84? 8 and 94? 8 tenths and 94 tenths? 94 twelfths and 8 twelfths?

8. How many are 7 and 7? 7 and 17? 7 and 27? 7 and 37? 7 and 47? 7 and 57? 7 and 67? 7 and 77? 7 and 87? 7 and 97?

9. How many are $8 and $6? 8 shillings and 16 shillings? 8 pence and 26 pence? 8 pounds and 36 pounds? 8 ounces and 46 ounces? 8 yards and 56 yards? 8 miles and 66 miles? 8 hours and 76 hours? 8 days and 86 days? 8 years and 96 years?

10. How many are 11 and 7? 8 and 9? 10 and 9? 7 and 14? 6 and 12? 9 and 15? 11 and 18? 15 and 12?

11. How many are 14 and 13? 16 and 14? 21 and 12? 24 and 13? 25 and 15? 27 and 13? 23 and 17?

12. How many are 29 and 11? 30 and 20? 34 and 15? 32 and 18?

13. Find the result of 8+2+5+7+9+6+4+7 ?= 48 Of 3+4+2+7+8+5+9+3+6+ ? How many are 47 8+9+3+6+7+5+4 ? Add 1, 2, 3, 4, 5, 6, 7, 8, 9. 45 42

14. How many are 7 inches and 4 inches ? 4 miles and 7 miles ? 7 pounds and 4 pounds ? 4 ounces and 7 ounces ? 4 tons and 7 tons ? 7 hundreds and 4 hundreds ? 5 tens and 4 tens ? 4 tens and 5 tens ? 7 tens and 8 tens ?

15. Find the sum of 40 and 50.

> *Ans.*—40 is 4 tens, 50 is 5 tens ; therefore 50 and 40 are 9 tens, or 90.

16. Paid 20 dollars for a cart, and 70 dollars for a horse : what did I pay for both ? $ 90

17. Peter gave away 20 marbles, and had 80 left : how many had he at first ? 100

18. Eliza paid 30 cents for a pen case, and 50 cents for a geography : what sum did both cost her ? 80

19. A farmer sold 20 bushels of turnips, 30 of barley, and 50 of wheat : how many bushels in all did he sell ? 100

20. What is the sum of 26 and 37 ? 63

> *Ans.*—26 is 2 tens and 6 units ; 37 is 3 tens and 7 units ; 2 tens and 3 tens are 5 tens ; and 6 units and 7 units are 13 units, or 1 ten and 3 units ; which, added to 5 tens make 6 tens and 3 units, or 63.

77 50 48

21. What is the sum of 33+44 ? 35+15 ? 36+12 ? 40+36 ? 40+29 ? 44+20 ? 48+32 ? 45+35 ?

22. 4+8+6+2+7+12+10+9 are how many ? 58

23 15+12+6+18+4+10+24+16+12 are how many ? 17

24. 22+23+11+15+16×2+28+12+15 are how many ? 58.

EXAMPLES.—4.

1. Jane has 13 pins in one cushion, and 27 in another how many has she in both? 40

2. Alfred gave 8 pears to William, 12 to Charles, 9 to James, and had 11 left: how many had he at first? 40

3. A woman paid 18 cents for a pound of cheese, 82 cents for a pound of tea, and 15 cents for nutmegs: how much did she spend in all? =116

4. From Halifax to Shubenacadie the distance is 41 miles, and from Shubenacadie to Truro the distance is 19 miles: find the distance from Halifax to Truro. 60

5. A grocer paid 47 dollars for corn meal, and 75 dollars for flour: what did both cost him? $122

6 A farmer has 12 acres in oats, 17 in rye, and 27 in wheat: how many acres in grain has he? 56

7. A fisherman caught 13 cod on Monday, 28 on Tuesday, and 59 on Wednesday: how many did he catch in the three days? 100

8. 73+17+3+7+10 are how many? 110

9. Willie gave 57 cents to his sister, and had 65 cents left: how many had he at first? 122

10. Brampton is 28 miles west of Toronto, and Bowmanville 43 miles east: find the distance between Brampton and Bowmanville. 71

11. A man began business with 28 thousand dollars, and in 10 years cleared 68 thousand dollars: how much was he then worth? 96000

12. A man bought a cow for 25 dollars, a calf for 5 dollars, 3 lambs for 8 dollars, and a pig for 2 dollars: what did he pay for all? $40

13. A horse is worth 85 dollars, and a waggon 35 dollars: what is the value of both? 120

14. Lucy bought a bonnet for 3 dollars, a silk dress for 19 dollars, and a shawl for 29 dollars: what did she pay for all? 51.

15. There are 31 days in January and 28 in February: how many days in both? 59

16. An orchard contains 15 cherry-trees, 37 plum-trees, and 45 apple-trees: how many trees are in the orchard? 67

17. A lady bought some tape for 10 cents, some pins for 18 cents, and a pair of scissors for 30 cents: how much did she pay for all? 58.

18. A merchant bought a horse, saddle and bridle; for the horse he gave 75 dollars, for the saddle 25 dollars, and 7 dollars for the bridle: what did they all cost him? 107

19. From Toronto to Whitby is 29 miles, and from Whitby to Port Hope is 33 miles: what is the distance from Toronto to Port Hope? 62

20. Bath is 18 miles from Kingston and 36 miles from Belleville: how far from Kingston to Belleville? 54.

21 Cobourg is 72 miles from Toronto and 103 miles from Kingston: how far from Toronto to Kingston? 175

22. From Montreal to Cornwall is 68 miles and from Cornwall to Kingston is 105 miles: what is the distance from Montreal to Kingston? 173

23. Oshawa is 33 miles from Toronto and 300 miles from Montreal: what is the distance from Montreal to Toronto? 333.

24. John hoes 19 rows of potatoes, James 31 rows, and William 48 rows: how many rows do they all hoe? 98

25. A grocer mixes 3 pounds of tea worth 12 shillings, with 4 pounds worth 20 shillings: how many pounds are there in the mixture?

26. A person sells 6 apples for 12 cents, and 9 others for 15 cents: how many apples does he sell, and what does he get for them? 5

27. James and Robert had equal amounts of money in the morning; during the day, James lost 6 dollars and Robert gained 9 dollars. In the evening, who had the larger amount, and how much larger? 15 more

28. A father divided a certain number of oranges between his wife, 2 sons and 3 daughters. He gave to the youngest son 5, to his wife 7, and the rest he divided equally between his three daughters and eldest son. The eldest son's share was 5 more that his mother's. How many oranges were divided? [illegible]

29. A father divided a certain number of apples between his three sons; to the first he gave 11, to the second 4 more than the first, and the third 7 more than the second: how many apples had he? · 28 ·

Section II.—Subtraction.

EXAMPLES.—5.

1. John had 3 cents and gave his brother 1: how many had he left?

Ans.—The difference between 3 (that is 1+1+1) and 1 is 2, therefore he had 2 left.

2. A boy had 5 apples and gave away 3: how many had he left? · 2 ·

3. Jennie had 8 needles and lost 5: how many had she remaining? 3.

4. Rufus caught 9 trout and gave Charles 3: how many had he left? 6·

5. How many are 3 and 2? 5 2 from 5 ? 3 from 5 ?

6. How many are 5 and 4 ? 4 from 9 ? 5 from 9 ?

7. How many are 6 and 3 ? 3 from 9? 6 from 9 ?

8. How many are 6 and 5 ? 5 from 11 ? 6 from 11 ?

9. How many are 4 and 7 ? 4 from 11 ? 7 from 11 ?

10. How many are 4 and 10 ? 4 from 14 ? 10 from 14 ?

11. How many are 8 and 5 ? 5 from 13? 8 from 13 ?

12. How many are 5 and 9 ? 5 from 14 ? 9 from 14 ?

13. How many are 7 and 10 ? 7 from 17 ? 10 from 17 ?

14. I paid 15 cents for oranges and 9 cents for apples : how much more did the oranges cost than the apples ? 6 cts

15. I had 17 dollars, and paid 12 dollars for two barrels of flour : how much had I left ? 5

16. Jane is 16 years old : how old was she 7 years ago ? 9

17. How many are 4 from 12 ? 8 4 from 13 ? 9 4 from 14 ? 10 4 from 15 ? 4 from 16 ? 4 from 18 ? 4 from 20 ? 4 from 24 ?

18. How many are 5 from 12 ? 5 from 14 ? 5 from 15 ? 5 from 17 ? 5 from 20 ? 5 from 22 ? 5 from 24 ?

19. James has 20 marbles and sells 6 of them : how many has he left ? 14

20. Bought a cart for 24 dollars and sold it for 17 dollars : how much did I lose ? 7

21. Bought a cow for 28 dollars and sold it for 40 dollars : find my gain ? 12

22. How many are 12 — 9 ? 15 — 9 ? 19 — 9 ? 16 — 6 ? 14 — 4 ? 25 — 5 ? 30 — 7 ? 27 — 7 ? 19 — 6 ? 14 — 8 ?

23. How many are 15 — 3? 24 — 4? 16 — 5? 17 — 8? 19 — 9? 29 — 8? 34 — 3? 35 — 6? 50 — 8? 57 — 6?

24. How many are 59 — 5? 53 — 7? 15 — 10? 36 — 16? 25 — 12? 20 — 14? 30 — 12? 29 — 10? 39 — 20?

25. How many are 24 + 2 — 3? 19 + 5 — 6? 30 + 45 — 12? 37 + 13 — 15? 45 + 15 — 10? 40 + 1 + 3 — 5?

26. How many are 40 + 1 + 3 — 5? 37 + 3 + 10 — 8? 25 + 15 + 5 — 9?

27. Begin with 67 and count back to 3, by subtracting 4 successively.

28. Begin with 50 and count back to 0, by subtracting 2; thus 50, 48, 46, &c.

29. What number must be put with 6 to make 9? 4 to make 10? 7 to make 13? 18 to make 40?

30. The sum of two numbers is 27, one of them is 13: what is the other? 14

EXAMPLES.—6.

1. Charlie had 25 cents; he spent 9 cents for a top and 3 cents for a string: how much had he left? 13

2. Isabella is 19 years old and Ida 11 years: find the difference of their ages. 8

3. How many is 6 from 13? 6 from 15? 6 from 16? 6 from 19? 6 from 22? 6 from 25? 6 from 27? 6 tens from 27 tens?

4. How many is 7 from 13? 7 from 16? 7 from 17? 7 from 19? 7 from 21? 7 from 22? 7 from 26? 7 from 27? 7 from 29? 7 hundred from 29 hundred?

5. How many is 11 — 8? 16 — 8? 24 — 8?

25 — 8? 27 — 8? 29 — 8? 3 — 8? 30 tens — 8 tens?

6. How many is 15 — 9? 18 — 9? 21 — 9? 22 — 9? 24 — 9? 27 — 9? $30 — $9? £32 — £9? 35 cents — 9 cents?

7. A man earns 45 dollars a month, he saves 9 dollars a month: how much does he spend?

8. From a pile of wood containing 30 cords, a teamster draws 13 cords: how many cords remained?

9. A man having 36 dollars, paid 20 dollars for a coat: how much had he left?

10. Count by fours from 4 to 58, and from 58 back to 4.

11. How many is 19 — 10? 21 — 10? 23 — 10? £28 — £10? $30 — $10? 35 — 10? 40 — 10? 50 — 10?

12. How many is 11 — 11? 13 — 11? 15 — 11? 17 — 11? 20 — 11? 22 — 11? 23 — 11? 25 — 11?

13. How many is 16 — 12? 19 — 12? 21 — 12? 24 — 12? 28 — 12? 30 — 12? 40 — 12? 47 — 12?

14. How many is 7 cents — 4 cents? 7 shillings — 6 shillings? 7 dollars — 6 dollars? 7 pounds — 4 pounds? 7 hundred — 4 hundred? 7 tens — 4 tens? 7 tenths — 4 tenths?

15. How many is 60 — 10? 36 — 10? 47 — 10? 31 — 10? 27 — 10? 60 — 20? 60 — 30? 70 — 20? 70 — 50? 80 — 40? 80 — 60? 75 — 30? 87 — 50? 40 pence — 25 pence? 70 shillings — 40 shillings?

16. What number must be added to the sum of 4 and 5 to make 12?

17. What sum must be added to the sum of 3, 6, 9, 15 to make 40?

18. The sum of three numbers is 67, the less number is 12, and the greater is 14 more than the less: what is the other?

19. 4+3—2+9—3+6—5+3—2+7—9+4—1+8—3 is how many? 1

20. 9+3—8+7—5+4—3+11—9+7—2+13—9+12—13+17—3 is how many? 31

21. From the sum of 9, 6, and 5, subtract the difference between 11 and 17.

22. What number must be added to the sum of 4, 7, and 5, diminished by the difference between 9 and 6 to make 20?

23. Subtract the sum of 9, 6, 8, 7, 4, from the sum of 5, 3, 11, 2, 13, 7, and 12.

24. The sum of two numbers is 63, the greater is 49: what is the less?

✓ **25**. What number taken from 29 will leave 18? 11

✓ **26**. The sum of three numbers is 34; the first is 13, and the second is 4 less than the first, find the third number. 12

27. By how much does the sum of 12 and 9 exceed the difference?

28. The minuend is 62 and the difference is 43. Find the subtrahend.

29. 4+5+6+7—2—3—5+9—6+3—1+9—7+6—2+5—4+13—11+16—6+9—7+21—11 is how many?

30. From 18 tens subtract 5 tens? Find the result of 17 hundred — 10 hundred. 28 fifths — 18 fifths. 23 fiftieths — 10 fiftieths.

EXAMPLES.—7.

1. John had 10 cents; he gave 2 cents for a pencil, and 4 cents for an orange: how many cents had he left? 4

2. William had 25 cents, and buys a penknife for 16 cents, and a pencil for 6 cents: how much has he left? 3

3. James had 40 cents, and paid 12 cents for a whistle, and 25 cents for a knife: how much had he left? 3

4. A school-boy paid 56 cents for a geography; 30 cents for an arithmetic: how much more did he pay for the geography than the arithmetic? 26

5. A drover bought 40 sheep of three farmers; he bought 8 of the first; and 16 of the second: how many did he buy of the third? 16

6. Jane had 9 oranges; her mother gave her 7 more, and her father enough to make 40: how many did her father give her? 22

7. A man travelled 5 miles before breakfast, 19 miles between breakfast and dinner, and then went back 12 miles: how far was he then from the place of starting? 12

8. Mr. Jones owes his grocer, baker, and butcher 50 dollars; he owes his baker 27 dollars, and his grocer 16 dollars: how much does he owe his butcher? 7

9. James goes up 3 steps of a ladder that has 24 steps, then down 2, then up 5, then down 4, then up 7, then down 3, then down 1, then up 9: what step from the top and bottom does he stand upon?

10. If a man who has $44 earns $27 more, and then spends $43, how much has he left? 28

11. A certain boat has a crew of 18 men, and 79 passengers: if 59 leave, how many are left aboard? 38

12. A and B start from two places, 96 miles apart, and travel toward each other. The first day, A goes 48 miles, and B 27: how many miles are they then apart? How far is A from B's starting place? How far is B from A's starting place? 21

13. Two men bought a horse, the one pays 75 dollars, and the other 29 dollars less: how many dollars did both pay?

14. From Toronto to Thornhill is 12 miles, from Thornhill to Richmond-hill is 5 miles: how far from Richmond-hill to Aurora, the distance from Aurora to Toronto being 31 miles?

15. John bought a watch for 15 dollars, and a chain for 9 dollars. He sold them both for 29 dollars: how much did he gain?

16. William and James start from the same point and travel in the same direction, the one at the rate of 13 miles, and the other at the rate of 7 miles: how far apart will they be?

17. On January 7th, how many days yet remain in the month? 24

18. Mary was born 6 years before Ann; Mary is 21 years old: how old is Ann?

19. How many is 90 — 50? 40

Ans.—90 is 9 tens, and 50, 5 tens, 9 tens — 5 tens are 4 tens, or 40.

20. How many is 75 — 25? 50 92 — 60? 32 87 — 40? 47 98 — 70? 67 — 42? 84 — 43? 96 — 36? 86 — 55? 31

21. How many is 75 — 37?

Ans.—75 is 60+15 and 37 is 30+7, therefore the difference is 60 — 30+15 — 7, which is 30+8 or 38 *or* 75 — 30 is 45, and 45 — 7 is 38.

22. How many is 46 — 35 ? 57 — 38 ? 39 — 19 ? 89 — 74 ? 43 — 28 ? 52 — 27 ? 67 — 39 ? 84 — 65 ?

✓ **23**. To the number 10, add 10 and subtract 5, add 5 and subtract 10, add 12 and subtract 6, add 6 and subtract 12, add 20 and subtract 10, add 20 and subtract 10, and give the result. 30

24. There are 65 scholars in a school, and 30 of them are girls : how many boys are there ? 35

25. A merchant bought 67 quintals of codfish, and in a week had sold all but 35 quintals : how many did he sell ? 32

26. A man began business with 42 thousand dollars, and in 5 years lost 22 thousand : how much had he left ? $20 000

27. Edgar had 19 peaches, he gave 7 to Mary and 6 to Minnie : How many had he left ? 6

28. Bought goods to the amount of 29 dollars : for how much must I sell them to gain 13 dollars ? $42

29. A bin has in it 55 bushels of oats, 23 bushels are taken out of it at one time and 9 bushels at another : how many bushels are left ? 23

30. Find result of 22 — 8 + 13 — 6 + 4 — 1 + 7 + 9 — 20, and also of 86 + 14 + 20 — 15 + 10 — 30. 20 . 85.

31. John earned 80 cents one day, and spent 30 cents of it, the next day he earned 50 cents : how much had he then ? $1.00

32. 9 tenths — 3 tenths ? 8 twelfths — 4 twelfths ? 23 fifteenths — 15 fifteenths ?

Section III.—Multiplication.

EXAMPLES.—8.

1. What will 2 apples cost at 4 cents each?

Ans.—1 Apple costs 4 cents, therefore 2 will cost 4+4 that is 2 *times* 4 cents or 8 cents.

2. What will 2 oranges cost at 5 cents each?

3. A man earns 8 dollars a week, how much will he earn in two weeks?

4. How many is:

2 times 1
2 times 2
2 times 3
2 times 4
2 times 5
2 times 6
2 times 7
2 times 8
2 times 9
2 times 10
2 times 11
2 times 12
5 times 2
8 times 2
10 times 2

5. Find the cost of 2 barrels of mackerel at 12 dollars a barrel, 24

6. What is the cost of 4 yards of tape at 3 cents a yard? at 4 cents? at 5 cents? 12

7. How many is:

3 times 1
3 times 2
3 times 3
3 times 4
3 times 5
3 times 6
3 times 7
3 times 8
3 times 9
3 times 10
3 times 11
3 times 12
8 times 3
11 times 3
12 times 3

8. What will 3 barrels of flour cost at 7 dollars a barrel? 21

9. A man earns 3 dollars a day, how much will he earn in a week?

10. Find the cost of 12 yards of calico at 3 pence per yard?

11. What will 4 pounds of rice cost at 6 cts. a pound? at 7 cents? at 8 cents? 24

How many is:

4 times 1
4 times 2
4 times 3
4 times 4
4 times 5
4 times 6
4 times 7
4 times 8
4 times 9
4 times 10
4 times 11
4 times 12
2 times 4
5 times 4
8 times 4

12. What will 4 pounds of sugar cost at 11 cents a pound? 44

13. Mary bought 4 yards of cotton at 9 cents a yard: what did it cost her? 36

14. I paid 4 dollars a day for a team and kept it 10 days: what did it cost me? 40

15. How many is 5 times: 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? How many is 8 times 5? 6 times 5? 7 times 5? 9 times 5 tenths? 4 times 5 tens? 7 times 5 hundredths?

16. Find the cost of 5 cords of wood at 6 dollars a cord? 30

17. 5 boys received 11 apples each: how many did they all receive?

18. At 5 cents a pound, what will 7 pounds of rice cost? 8 lbs.? 9 lbs.? 10 lbs.? 12 lbs.? 35 40 - 45 50 60

19. How many is 6 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 2 tens? 5 tens? 7 thirds? 8 fourths?

20. I paid 6 dollars a ton for 9 tons of coal: what was the whole cost? 54

21. Jane bought 11 yards of cotton at 6 pence per yard: what did it cost her? 66

22. How many is 7 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 2 pence? 3 shillings? 4 tenths?

23. A merchant averages a profit of 12 dollars a day: how much is that a week? $72

24. A merchant bought 7 quintals of codfish at 5 dollars a quintal: what did he pay in all? 35

25. How much will 8 yards of silk cost at 9 shillings a yard? 9 inches of gold wire at 7 pence an inch? £3 12 5/3

26. How many is 8 times 1? 2? 3? 4? 5? 6?

7? 8? 9? 10? 11? 12? How much is 12 times 8? 7 times 8?

27. Find the cost of 2 lbs. of sugar at 10 cents per pound? Of 8 barrels of flour at 7 dollars a barrel? '20 $56

28. A steamer sails 12 miles an hour for 7 hours: what distance does she make? 84

29. What will be the cost of 9 lbs. of cheese at 8 pence a pound? 9 yards of cotton at 8 pence a yard? 72 .72

30. How many is 9 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? How many is 8 times 9? 7 times 9?

31. How many inches are in 9 feet, there being 12 inches in one foot? 108

32. A farmer makes an average profit of 11 dollars an acre: what profit has he off 9 acres of land? .99

33. How many is 10 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? How many is 9 times 10? 8 times 10?

34. What will 10 lbs. of butter cost at 9 cents a pound? at 10 cents? at 11 cents? 90

35. What will 9 yards of muslin cost at 11 cents a yard? 99

36. How many is 11 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 12 times 11? 9 times 11? 7 times 11?

37. Find the cost of 11 yards of ribbon at 11 cents a yard? 10 quintals of codfish at 4 dollars a quintal? 121

38. I bought 11 lbs. of halibut at 9 cents a pound: what did it cost me?

39. How many is 12 times 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 2 farthings? 4 ounces? 5 tens? 7 twelfths?

40. What will 12 dozen of eggs cost at 12 cents a dozen?

41. What will 9 tops cost at 5 pence each?

42. What will 8 knives cost at 6 dimes each?

43. At 12 cents each, what will 9 primers cost?

44. What will 8 yards of broadcloth cost, at 4 dollars a yard?

45. If a boat moves at the rate of 11 miles an hour: how far will it go in 11 hours?

46. Mr. Finkle's stage, moving at the rate of 6 miles an hour, takes 4 hours to go from Newburgh to Kingston: how far from Newburgh to Kingston?

47. If a steamer sails 7 miles in an hour: how far will she travel in 7 hours? In 9 hours? In 11 hours? In 12 hours?

48. At 7 cents a pound: what will 8 pounds of beef cost? 10 pounds? 6 pounds? 12 pounds?

49. How much is 8 times 2-fifths? 9 times 3-tenths? 12 times 8-twelfths? 6 times 3-elevenths?

50. How much is 7 times 5 pence? 5 shillings? 5 hours? $5? £5? 5-tenths? 5-twentieths? 5 hundreds? 5 thousandths?

EXAMPLES 9.

1. What are the factors of 6? 10? 15? 21? 36?

2. When 10 is a factor, with what figure does the product always end?

3. When 5 is a factor, with one of what two figures does the product always end?

4. How much greater is 11×9 than 10×7? 29

5. A farmer sold 8 sheep at 5 dollars each, and 9 pigs at 6 dollars each: how much did he receive in all? 94

6. How much is 12×5? 5×11? 7×9? 12×8? 7×7? 9×7? 7×9? 10×11? 9×14?

7. A man's wages is 13 dollars a month he spends 5 dollars a month: how much does he save in a year?

8. 10 men can mow a field in 12 hours: how long would it take one man to do it?

Sol.—It will take one man ten times as long as 10 men—10 times 12 is 120 hours?

9. If 5 men reap a field in 7 days, how long will it take 1 man?

10. A quantity of provisions will last 8 men 12 days: how long would it last 1 man?

11. 9 horses eat 80 bushels of oats in 20 days: how long will that quantity last 1 horse?

12. It takes 8 men 8 days to do a piece of work: how many men will do it in 1 day?

Sol.—8 men do it in 8 days ∴ 64 men will do it in *one* day.

13. How many men must be employed to do a piece of work in one day, which it takes 11 men 12 days to do?

14. A tailor has 43 yards of broadcloth; if he sells 23 yards of it, what will the remainder be worth at 6 dollars a yard?

15. If 6 pipes of equal size can fill a cistern in 12 hours, in how many hours could one of them fill it?

16. 12 men dig a ditch in 11 days: how many men would dig it in one day?

17. Three times 26 are how many?

Sol.—In 26 there are 2 tens and 6 units. 3 times 6 units is 18 units, or 1 ten and 6 units, and 3 times 2 tens is 6 tens, which with 1 ten and 8 units make 7 tens and 8 units, or 78.

18. How many is 4 times 18? 23? 25? 13? 32? 5 times 75? 6 times 84? 7 times 92? 8 times 15 tens?

19. What are the factors of 8? 15? 22? 35? 21? 14? 16? 32? 96? 84? 100? 120?

20. Find as many sets of factors as you can for 24. For 30. For 48. For 16.

21. How much is 14 times 13?

Analysis.—The factors of 14 are 7 times 2 ∴ 14 times 13 is equal to 7 times 13, multiplied by 2. 7 times 13 is 91; twice 91 is 182.

22. How much is 18 times 23? 15 times 38? 16 times 26? 14 times 72? 21 times 17? 35 times 13? 25 times 19? 32 times 26?

23. Five times twelve, less ten, plus 15, is how many?

24. How much more is 8 times 8 than 7 times 9?

25. If two men start from the same place and travel in opposite directions, the one travelling at the rate of 3 miles an hour, and the other at the rate of 4 miles an hour, how far apart will they be at the end of 5 hours?

26. Two men start 50 miles apart and travel towards each other, the one at the rate of 4 miles an hour, the other at the rate of 3 miles: how far apart will they be at the end of 5 hours? 15 miles

27. Find the result of $6\times20\times15$; and of $21\times7-3\times11$.
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28. For how much must I sell 25 barrels of mackerel which cost me 8 dollars a barrel, so as to gain 50 dollars?

29. Bought 5 cords of wood at 6 dollars a cord, and handed in payment 4 ten-dollar bills: how much change should I receive?

30. A farmer sold 7 sheep at 5 dollars each, and 3 lambs at 2 dollars each: how much did he get for them all?

31. A tailor has a piece of cloth containing 23 yards; if he should cut from it 13 yards, what will the remainder be worth at 4 dollars a yard?

32. A and B travelling toward each other met in 12 hours: how far apart were their starting points, if A went 10 miles an hour, and B 12?

33. Find first the sum, then the difference, and then the product of 10 and 35. Of 11 and 36.

34. How many yards in 14 pieces of cloth, each containing 37 yards?

35. Bought 23 cows for $48 each; sold them at $60 apiece: what was the profit on each and on the whole?

36. Two men start at the same place and travel in the same direction; one at the rate of 7 miles an hour, and the other at the rate of 3 miles an hour: how far apart will they be in 9 hours?

37. A man bought a horse for $90, paid $3 a week for his expenses, and received $5 a week for his work; at the expiration of 8 weeks he sold him for $80: did he gain or lose by the operation, and how much?

38. If a traveller, starting from any point, travels 10 hours, at 4 miles an hour, and then returns at the rate of 5 miles per hour for 3 hours, how far is he then from the place of departure? 25 miles

Section IV.—Division.

EXAMPLES.—10.

1. At 2 cents each, how many apples can be bought for 6 cents?

Sol.—Every 2 cents will buy an apple; 2 is contained in 6 3 times : therefore 3 apples can be bought for 6 cents.

2. At 4 cents each, how many oranges can be bought for 12 cents?

3. For 24 cents how many pounds of sugar can be bought at 8 cents a pound?

4. Paid 32 dollars for 8 cords of wood : how much is that a cord?

5. 3 times 2 are 6 : how many times is 2 contained in 6? 3 in 6?

6. 15 is how many times 3? how many times 5? 12 is how many times 2? how many times 6? how many times 4? 3?

7. How many times 4 are 8? 16? 12? 20? 24? 28?

8. John spent 30 cents in pencils, at 6 cents each: how many did he buy?

DIVISION TABLE.

1 in	2 in	3 in	4 in	5 in	6 in
1, once	2, once	3, once	4, once	5, once	6, once
2, twice	4, twice	6, twice	8, twice	10, twice	12, twice
3, 3 times	6, 3 times	9, 3 times	12. 3 times	15, 3 times	18, 3times
4, 4 "	8, 4 "	12, 4 "	16, 4 "	20, 4 "	24, 4 "
5, 5 "	10, 5 "	15, 5 "	20, 5 "	25, 5 "	30, 5 "
6, 6 "	12, 6 "	18, 6 "	24. 6 "	30. 6 "	36, 6 "
7, 7 "	14, 7 "	21, 7 "	28 7 "	35, 7 "	42, 7 "
8. 8 "	16, 8 "	24, 8 "	32, 8 "	40, 8 "	48, 8 "
9, 9 "	18, 9 "	27, 9 "	36, 9 "	45, 9 "	54, 9 "
10, 10 "	20, 10 "	30. 10 "	40, 10 "	50, 10 "	60, 10 "
11, 11 "	22, 11 "	33, 11 "	44, 11 "	55, 11 "	66, 11 "
12, 12 "	24, 12 "	36, 12 "	48, 12 "	60, 12 "	72, 12 "

9. A boy paid 12 cents for pens at 2 cents each : how many did he buy?

10. At 3 dollars a yard, how many yards of silk can be bought for 27 dollars?

11. A horse trotted 48 miles in 6 hours: how many miles an hour did he average?

12. A farmer gave 60 dollars for sheep, paying 6 dollars a head: how many did he buy?

13. A carpenter earns 12 dollars a week: how long will it take him to earn 72 dollars?

14. A bag contains 3 bushels: how many such bags will be required to hold 36 bushels?

15. One man can do a piece of work in 66 hours: in how many hours can 6 men do the work?

16. It takes 50 men one week to do a certain work: how many weeks would it take 10 men?

Division Table—Continued.

7 in	8 in	9 in	10 in	11 in	12 in
7, once	8, once	9, once	10 once	11, once	12, once
14, twice	16, twice	18, twice	20, twice	22, twice	24, twice
21, 3 times	24, 3 times	27, 3times	30, 3 times	33, 3 times	36, 3 times
28, 4 "	32, 4 "	36, 4 "	40, 4 "	44, 4 "	48, 4 "
35, 5 "	40, 5 "	45, 5 "	50, 5 "	55, 5 "	60, 5 "
42, 6 "	48, 6 "	54, 6 "	60, 6 "	66, 6 "	72, 6 "
49, 7 "	56, 7 "	63, 7 "	70, 7 "	77, 7 "	84, 7 "
56, 8 "	64, 8 "	72, 8 "	80, 8 "	88, 8 "	96, 8 "
63, 9 "	72, 9 "	81, 9 "	90, 9 "	99, 9 "	108, 9 "
70, 10 "	80, 10 "	90, 10 "	100, 10 "	110, 10 "	120, 10 "
77, 11 "	88, 11 "	99, 11 "	110, 11 "	121, 11 "	132, 11 "
84, 12 "	96, 12 "	108, 12 "	120, 12 "	132, 12 "	144, 12 "

17. When flour is 7 dollars a barrel, how much can be bought for 63 dollars?

18. How much will 70 yards of cotton cost at the rate of 10 yards for 1 dollar?

19. How much halibut at 12 cents a pound can be bought for 96 cents?

20. A freight train is moving 12 miles an hour: how long will it be moving 84 miles?

21. How much is 6 times 10 divided by 5? by 12? by 4?

22. 9 times Mary's age is 108: find her age?

23. If one horse can eat a quantity of oats in 144 days, how long will it take 12 horses to eat an equal quantity?

24. How long will it take 11 men to do a certain work, if 55 men can do it in 1 day?

NOTE.—The sign of division is ÷, thus 15÷5 means that 15 is to be divided by 5.

25. At 3 cents each how many apples could you buy for 8 cents, and how many cents would you have left?

26. What is the quotient of 40÷5? 40÷8? 40÷10?

27. 45 are how many times 5? 9? 10? 11? 15?

28. If you had 63 dollars, how many sheep could you buy at 6 dollars each, and how many dollars would you have left?

29. How many times is 4 contained in 28? 5 in 15? $6 in $24? 3 cents in 27 cents? £2 in £16? 1 hour in 9 hours? 5 dimes in 35 dimes? 6 tens in 36 tens? 2 fifths in 12 fifths? 3 ounces in 36 ounces? 5 tenths in 55 tenths?

30. How many times is 7 contained in 14? 9 in 36? 10 in 40? 8 in 56? 11 in 33? 9 in 54? 12 in 72? 7 in 70? 10 in 70? £11 in £99? 8 guineas in 40 guineas?

31. How many times is 2 contained in 24? 12 in 24? 3 in 18? 6 in 18? 12 in 108? 8 in 96? 9 in 99? 11 tens in 121 tens? 12 hundred in 144 hundred? 10 tenths in 120 tens? 9 thousand in 45 thousand?

32. What is the quotient, and what the remainder in the following? 14÷5? 68÷7? 9÷2? 39÷4? 112÷11? 62÷10? 61÷7? 51÷8? 19÷2? 63÷5? 140 days÷12 days? 150 pence÷12 pence? $133÷$11? 27 ounces÷10 ounces?

EXAMPLES.—11.

1. 3 times a number + 4 times the number — twice the number + 7 times the number — 5 times the number equals 35: what is the number?

2. John being asked his age replied : if you add 20 to 8 times my age the sum will be 100 : find his age.

3. What number must be taken from 95 so that the remainder may be exactly divisible by 10 ?

4. What number must be added to 129 to get a sum exactly divisible by 12 ?

5. Divide 38 tens by 2 tens ; 54 tenths by 3 tenths ; 65 by four ; 87 weeks by 5 weeks ; 136 by 4 ; 121 shillings by 4 ; 238 days by 3 ; 308 months by 6 ; 150 guineas by 12.

6. Bought 12 yards of broadcloth at 6 dollars a yard, and paid for it with wood at 4 dollars a cord : how many cords did it take ?

7. The remainder is 4, the dividend 148, and the quotient 12 : find the divisor.

8. A house was bought for $1200, and sold for $1500. The profit was divided between 6 persons : what was the share of each ?

9. What number multiplied by 7 will give the same product as 14 multiplied by 9 ?

10. What number must be added to 29, so that it may be exactly divisible by 9 ?

11. If the sum of 9 and 7 be multiplied by their difference, and the product divided by 8, what will the quotient be ?

12. What number must 4 be multiplied by, so as to produce twice 32 ?

13. The sum of the product of two numbers and 6 is 34, one of the numbers is 7, find the other ?

14. What number subtracted 11 times from 456, leaves remainder 5 ?

15. A man gave $12 each to a certain number of men, and had $5 left of $125 : how many men were there ?

16. Charles said :—if you multiply the number of dollars I have by 12, and subtract $15 from the product the remainder will be $69 : how much money had he ?

17. 5 times 12 is how many times 48÷6 ?

18. 9 times 1 is how many times 54÷9 ?

19. I received 30 yards of tweed for 5 tons of hay at $12 a ton : what was the cloth a yard ?

20. Willie having been asked how many dollars he had, replied : if you add 9 to the number and multiply the sum by 8, the product will be $160 : how much had he ?

21. Minnie having been asked her age, said : 9 times my age 6 years ago is 81 : find her age.

22. 6 times my present age is 9 times my age 5 years ago : how old am I ?

23. At 15 cents a yard how much wincey can be bought for 300 cents ? for 400 ?

24. If a quantity of provisions last 1 man 48 days, how long will it last 4 men ? 6 men ? 8 men ? 12 men ?

25. A woman sold 12 dozen of eggs at 15 cents a dozen, and with the proceeds bought raisins at 18 cents a pound : how many pounds did she get ?

26. At 15 dollars an acre how much land can be bought for $180 ? $300 ? $450 ? $600 ?

27. If 6 times Mary's age is divided by 12, the quotient, multiplied by 15, will be 75 : find her age.

28. A man paid $220 dollars for 10 months board : how much did he pay per month ?

29. A merchant's expenses are $12 a day : in how many days will they amount to $900 ?

Section V.—Miscellaneous Questions.

EXAMPLES. —12.

1. Multiply 30 by 4, subtract 50, add 10, divide by 5, multiply by 7, and what is the result?

2 Subtract 10 from 6 multiplied by 8, to the remainder add 4, divide the sum by 6, multiply the quotient by 11, subtract 7 from the product, divide the remainder by 10, add 30 to the quotient, and what will be the sum?

3. 70 barrels of pork cost $5.60: what was the price per barrel?

4. One man can do a work in 55 days: how long will it take 10 men?

5. A number multiplied by 8, divided by 6, multiplied by 10, and the product increased by 5, equals 45: what is the number?

6, Multiply 15 by 5, add 5, divide by 8, multiply by 6, subtract 10, divide by 5, add 2, multiply by 11, and what will the product be? 132

7. The divisor is 5, the dividend 39, the quotient 7, Find the remainder. 4

8. The remainder is 5, quotient 6, divisor 7. Find the dividend.

9. How many sets of factors in 24? in 48? in 60? in 125?

10. By what number must the product of the sum and difference of 9 and 7 be increased so that the result may be exactly divisible by 7?

11. A man bought an equal number of pigs and sheep for $63. Each pig cost $3, and each sheep $4: how many of each did he buy?

12. A woman bought 26 yards of dress goods at 30 cents a yard, and 22 yards of cotton at 10 cents a yard: how much change did she receive out of a $10 bill?

13. There is a number which, when divided by 4, and the quotient increased by 9, the sum multiplied by 3, and the product decreased by the difference between the arithmetical complements of 4 and 7, gives 33. Find the number?

14. If 3 cords of wood are worth 18 dollars, and 10 cords are given for 12 thousand shingles, how much are the shingles a thousand?

15. If 3 pounds of flour are worth 1 pound of sugar, and 6 pounds of sugar are worth 1 pound of tea, how many pounds of flour are worth 2 pounds of tea?

16. A boat sailed up river for 10 hours at the rate of 3 miles an hour, but returned over the same distance in 6 hours: how fast did it sail down stream?

17. When wheat is sold at the rate of 6 bushels for 12 dollars, how many bushels must be given for 4 cords of wood, at 5 dollars a cord?

18. A steamboat can run 8 miles an hour down river, and only 6 miles an hour up river; after running down river for 3 hours, how long will it be in returning?

19. Twenty acres of land are bought for $30: how many dollars per acre must they be sold for, that the purchaser may double his money?

20. I divide 25 oranges between two boys, giving one 7 more than the other: how many will each have?

21. If four barrels of flour are worth $36, how many yards of cloth worth $3 a yard will 2 barrels of the flour buy?

22. A boy on his way to market with 17 lobsters, lost

3 of them; the rest he sold for $1.12: how much was that apiece?

23. Bought 6 barrels of pork for 120 dollars: at how much a barrel must it be sold to gain $2 a barrel?

24. Divide 15 cents between John and James so that John may have 3 cents less than James.

25. At 2 dollars a bushel, how many bushels of wheat must be given for 4 barrels of flour at $8 a barrel?

26. A man can do a piece of work in 4 days when the days are 12 hours long: how long will he take when the days are 8 hours long?

27. Exchanged 11 tons of hay for 15 yards of cloth at 6 dollars a yard, and 4 yards at 5 dollars a yard: how much was the hay worth a ton?

28. A man can do a piece of work in 5 days by working 8 hours a day: how many hours a day must he work to do it in 4 days?

29. Two men are 96 miles apart, and are travelling toward each other, one at the rate of 5 miles an hour, and the other at the rate of three miles an hour: in how many hours will they meet?

Section VI.—Analysis.

EXAMPLES.—13.

1. When a number is divided by 2, the quotient is one of the two equal parts which compose the number, and is called *one-half of the number,* thus:—6 divided by 2 gives quotient 3, which is one of the two equal parts (3+3) that compose 6, and is therefore *one-half* of 6.

2. So, when a number is divided by 3, the quotient is *one-third* of the number; when divided by 4 the quotient is *one-fourth*; when divided by 5, *one-fifth*; and when divided by 6, *one-sixth.*

3. What is one-half of 6? of 8? of 24? of 8 tens? of 16 hundred? What is the *one-third* of 3? of 6? of 9 fifths? of 27 tenths? What is the *one-fourth* of 8? of 12? of 36? of 60 twelfths? What is the *one-fifth* of 5? of 15? of 20? of 40? What is the *one-sixth* of 12? 18? 30? 42? 54? What is one-sixth of 36 pence? 36 ounces? 36 minutes? 36 tons? 36 tenths? 36 twentieths?

4. how many halves are there of any number? How many thirds? fourths? fifths? sixths?

5. How much is one-third of 9? 2 thirds of 9? How much is one-fourth of 12? 3 fourths? How much is one-fifth of 15? 2 fifths? 4 fifths? How much is one-sixth of 24? 3 sixths? 5 sixths?

6. When a number is divided by 7 the quotient is called one-seventh of the number; when divided by 8, one-eighth; when divided by 9, one-ninth; when divided by 10, one-tenth; when divided by 11, one-eleventh; and when divided by 12, one-twelfth.

7. How many sevenths are there of any number? How many eighths? ninths? tenths? elevenths? twelfths?

8. How much is one-seventh of 14? 21? 42? How much is 2 sevenths of 35? 3 sevenths? 4 sevenths?

9. How much is one-eighth of 40? 3 eighths? 7 eighths.

10. How much is one-ninth of 9? of 18? of 81? How much is 4 ninths of 27? 5 ninths? 7 ninths?

How much is one-ninth of 27 pounds? 36 farthings? 45 days? 54 grains? 63 tens? 72 tenths? 72 fifths?

11. How much is one-tenth of 10? of 30? of 70? How much is 2 tenths of 50? 3 tenths? 6 tenths? 10 tenths?

12. How much is one-eleventh of 22? 2 elevenths? 4 elevenths? 7 elevenths? 9 elevenths? 10 elevenths?

13. How much is one-twelfth of 12? of 36? of 72? of 84? of 96? How much is one-twelfth of 108? 3 twelfths? 7 twelfths? 9 twelfths? 12 twelfths?

14. One-half a number is 10, what is the number?

Sol.—Since *one* half is 10, *two* halves, or the whole number, is 2 times 10 or 20.

15. One-fifth of my age is 6 years: how old am I?

16. What is the number whose sixth part is 10? The number whose seventh part is 8? The number whose ninth part is 9? The number whose tenth part is 10?

17. The rent of a house for a certain time is $60, what is the rent for one-sixth of the time? for 2 sixths? for 5 sixths?

18. A man has $36 a month, and saves 2 ninths of it: how much does he save in 12 months? 96

19. One-seventh of the money I have is $12: how much have I? $84

20. If 22 is one-sixth of the value of a horse, find his value? $132

21. What is 5 eighths of 16 yards? 10 of 16 dollars? of 16 cents? of 16 years? of 16 days? of 16 pence? of 16 farthings? of 16 hundredths?

22. There are 12 months in a year, how many in one-sixth of a year? in 2 sixths? in 5 sixths?

23. One pound of cheese costs 18 cents, what will one-half pound cost? one-third of a pound? 5 sixths of a pound.

24. Five-sixths of 72 are how many times 6? how many times 12? how many times 10?

25. James is 16 years old, and 3 fourths of his age is 6 sevenths of Harry's: how old is Harry?

Examples.—14.

1. If 3 oranges cost 15 cents, what will 7 oranges cost?

Sol.—3 Oranges cost 15 cents, *one* will cost one-third of 15 cents, that is 5 cents, therefore 7 will cost 7 times 5 cents, or 35 cents.

2. If 7 apples cost 14 cents, what will 11 cost? - 22

3. If 9 mackerel cost 81 cents, what will 12 cost?

4. If 15 yards of tape cost 45 cents, what will 8 yards cost?

5. $84 are paid for 12 barrels of herring: what would be the price of 10 barrels? 70.

6. If six men can mow 12 acres of grass in a day, how much can 13 men mow in the same time?

7. If 3 apples are worth 6 oranges, how many oranges are 20 apples worth? . 40

8. If 8 dollars will buy 80 yards of cotton, how much will 11 dollars buy?

9. When 60 cents are paid for 4 dozen of eggs, how much must be paid for 7 dozen?

10. If 50 cents will pay for 5 lbs. of sugar, how much will 120 cents buy?

Sol.—5 pounds cost 50 cents, 1 pound 10 cents, and if 10 cents buy 1 pound, 120 cents will buy 120÷10, that is 12 pounds.

11. If 8 men build a wall in 6 days, how many would build it in 12 days?

12. When $80 is paid for 8 barrels of mackerel, how many barrels will $110 pay for?

13. If 8 yards of calico can be bought for 96 pence, how much can be bought for 132 pence?

14. If 4 men do mow a field in 12 days, how long would it take 6 men?

> *Sol.*—4 men do it in 12 days, therefore 1 man will do it in 48 days, and 6 men will do it in one-sixth of 48 days, or 8 days.

15. How long would it take 11 men to do what 10 men would do in 11 days?

16. If 10 cents will buy 5 herrings, how much will 40 herrings cost?

17. When five yards of broadcloth can be bought for 20 dollars, how much will $56 buy?

18. If 8 copy-books cost 80 cents, what will 40 copy-books cost.

> *Sol.*—Since 40 is 5 times 8, 40 books will cost 5 times what 8 cost, or 5 times 80, that is 400 cents.

19. What will 15 oranges cost, when 3 cost 11 cents?

20. How many dozen of eggs can be bought for 90 cents, at the rate of 2 dozen for 30 cents?

21. What will 21 pounds of rice cost, if 13 pounds cost 65 cents?

22. How much will 40 barrels of flour cost, when 5 barrels cost 26 dollars?

23. How much honey at 12 cents a pound must be given for 4 pounds of coffee at 30 cents a pound?

24. What is the cost of 30 yards of cloth at the rate of 5 yards for 9 dollars?

25. If 12 men do a piece of work in 10 hours, how long would it take 8 men to do the same work?

26. If a steamer make 48 miles in 4 hours, how long will it take her to make 72 miles?

27. If 3 fourths of a number is 12, what is 5 times the number?

28. If 4 fifths of a pound of tea cost 60 cents, what will 2 pounds cost?

29. If 10 horses eat 30 bushels of oats in 6 days: how long will the same quantity last 15 horses?

30. What will 3 fifths of a pound of tea cost, at 60 cents a pound?

31. Charlie gave 7 apples for 21 marbles: at this rate how many marbles ought he to get for 9 apples?

32. How much will 5 bushels of apples cost, if 5 eighths of a bushel cost 40 cents?

33. 3 tenths of the distance from Yarmouth to Digby is 21 miles: find the whole distance?

34. A man gave 15 bushels of wheat for 3 barrels of flour: what was the wheat worth a bushel when $60 would buy 12 barrels of flour?

35. Frank has 60 cents, and 7 tenths of this sum is equal to 6 sevenths of what Willie has: how much has Willie?

36. A man paid $40 for a chain, which was 2 ninths of what his watch cost: find the cost of the watch?

37. A farmer has 36 geese, and 7 ninths of the number of geese is 4 fifths of the number of turkeys: find the number of turkeys?

38. John has three times as much money as Edward, and both have $16: how much has each?

Sol.—John has a certain sum and Edward has 3 times this sum, therefore both together have 4 times John's money, or $16, and therefore John's is $4, Edward's $12.

39. A lot and house cost $900, the house cost 8 times as much as the lot: find the cost of each?

40. Edwin is twice as old as Edgar, and their united ages is 30 years: find the age of each?

41. A horse and cart cost $108; the horse cost 5 times as much as the cart: find the cost of each?

42. 72 cents are divided between Harry and Charlie, for every 4 cents Harry receives, Charlie gets 5: how many does each receive?

Sol.—Of *every* 9 cents Harry gets 4 and Charlie 5, but 9 is contained 8 times in 72, therefore Harry gets 8 times 4 cents and Charlie 8 times 5 cents.

43. Divide 60 marbles between Willie and Eddie, so that for every 2 Willie gets, Eddie shall get 3.

44. Divide $132 between Minnie and Susie in such a way, that as often as Minnie gets $4, Susie shall get $7?

45. A newsboy saves 104 cents in 8 days: how much will he save in 30 days at the same rate?

46. If it take 20 yards of calico to make 2 dresses, how many similar dresses will 110 yards make?

47. A boy laid out 80 cents in oranges at 4 cents each, and sold them so as to gain 40 cents: find how much he got apiece for the oranges?

48. On a certain holiday William caught 11 trout as often as Charles caught 7; William caught 55: how many did Charles catch?

49. Frank laid out 60 cents in apples, giving 5 cents for every apples; he kept a number for himself and gave an equal number to each of 8 class mates: how many did each receive?

50. If 9 barrels of flour are worth $63, how many barrels of apples at $3 a barrel can be had for 6 barrels of flour?

51. A newsboy bought 9 papers at 3 cents each, and 8 others at 4 cents each; he sold all the papers at a uniform price, and gained altogether 26 cents: find what he received for each paper?

52. If $100 will support a family of 7 persons for 8 weeks, how many persons would it support for 14 weeks?

53. Two-thirds of 36 are 3 times what number? 4 times what number? 6 times what number? 8 times what number?

54. Eight-ninths of 81 are 6 times what number? 8 times what number? 9 times what number? 12 times what number?

55. Four-fifths of 60 are how many times 6? how many times 8? Ten-elevenths of 55 are how many times 5? 10? 25?

Section VII.—Highest Common Factor, &c.

EXAMPLES.—15.

1. What numbers multiplied together will produce 8? 10? 16? 35? 48? 40? 45? 51? 42?

2. Resolve into factors, 15, 20, 25, 33, 36, 40, 50.

3. What factors have the following numbers: 2, 3, 5, 7, 11, 13, 17, 19, 22, 23, 27, 32?

4. Name the *prime* and the *composite* numbers in the following, 24, 25, 27, 28, 29, 30, 31, 34, 35, 37, 36, 39, 41, 47, 54?

5. What are the factors of 6? 9? 12? 15? 10? 18? 21? 32? 33? 35? 39? 49? 51?

6. What are the *prime factors* of 44? 54? 56? 60? 57? 68? 70? 75? 76?

7. Name the divisors which are common to 8 and 10? 12 and 16? 10 and 30? 9 and 36? 24 and 36?

8. Find the highest common factor of 8 and 24, 36 and 27, 32 and 48, 37 and 68, 18 and 80?

9. Find a common multiple of 2 and 3, 5 and 6, 4 and 8, 9 and 12, 32 and 48?

10. Find the *least* common multiple of 8 and 12, 9 and 12, 12 and 20, 16 and 48, 10 and 35, 48 and 96?

11. What is the *square* of 1? 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12? 13? 15? 14? 20?

12. Find the *cube* of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

13. What is the square *root* of 1? 4? 9? 16? 25? 36? 49? 81? 64? 100? 144? 121?

14. 5 times the square of a number is 320: find the number?

15. If the square root of a certain number be divided by 6, the quotient is 2: find the number.

16. If 11 be added to Harry's age, and 1 is added to 5 times the square root, ½ of the sum will be nine: find his age.

Highest Common Factor and L. C. M.

Examples—16.

1. What is meant by Common Factor, Highest Common Factor?

2. Find the H.C.F. of 4 and 6, 7 and 14, 8 and 12, 27 and 36, 56 and 14.

3. Find the H.C.F. of 2, 4, 6, 8, and 12; of 5, 15, 25, and 39.

4. What is meant by the multiple of a number? what by the L.C.M. of two or more numbers?

5. Find the L.C.M. of 4 and 6; 9 and 12; 8, 16, and 32; 4, 6, 9, 18, and 36.

6. Find the L.C.M. of 2, 4, 6, 8 and 12; 5, 15, 10, 20 and 30; 3, 6, 9, 24 and 36.

7. A farmer wishes to put 24 bushels of wheat and 36 bushels of silver chaff into the least number of bins that shall contain the same number of bushels without mixing the two kinds of wheat: what number of bushels must each bin hold, and how many bins will be required?

8. A gentleman has a triangular plot, the sides of which are 63, 84, and 105 feet, wishes to enclose it with boards of uniform length and greatest possible: what will be the length of each board? How many boards will be required if it be 4 boards high all round?

9. A, B, and C agree to purchase pigeons at the highest price each that will allow each to invest all his money; A has 45 cents, B, 60, and C, 75: how many can each purchase?

10. A can dig 4 rods of a ditch in a day; B, 6; and C, 8: what is the least number of rods that will furnish a number of whole days' work to any of the three men?

11. The fore wheel of a perambulator is 3 feet in circumference and the hind wheel 5: what distance will be passed over before they are in the same relative position as at first?

12. The H.C.F. of two numbers is 2, and the L.C.M. is 12; one of the numbers is 4: what is the other?

13. The H.C.F. of three numbers is 2, and their

L.C.M is 60; the first number is 4, the second 2 more than the first: what is the third?

14. Find the least number which, divided by 3, 5 and 7, leaves 2 for remainder in each case.

15. What is the smallest sum of money with which I can buy rabbits at 25 cents each, pigeons at 15 cents each, and hens at 30 cents each?

16. A boy can dig 12 post holes in a day; his brother can dig 18: what is the smallest number which will furnish exact number of days' labor for either alone or both together?

17. What is the least number which, divided by 3, 5, 7, 9 and 15, will leave 1 for remainder?

18. What is the greatest and what the least number that can be subtracted an exact number of times from 55?

19. What is the greatest and what the least number that can be subtracted from 153 an exact number of times?

CHAPTER II.

Section 1.—Fractions.

INTRODUCTORY.

EXAMPLES.—1.

1. If anything, as a foot, a dollar, a pound, a number, &c., is divided into two equal parts, each part is one-*half* of the thing divided; if it is divided into three equal parts, each is one-third, and two of the parts are *two*-thirds; if it is divided into four equal parts each is one-*fourth*, *two* of them are *two*-fourths, and three of them *three*-fourths; if it is divided into five equal parts, each is one-*fifth*, two of them are *two*-fifths, three of them *three*-fifths, four of them *four-fifths*; and so on for other divisions. Now, instead of *words*, we may use figures to express one or more of the equal parts into which the thing has been divided, thus:—

One-half is represented by $\frac{1}{2}$, *two* halves by $\frac{2}{2}$; one-third is represented by $\frac{1}{3}$, *two*-thirds by $\frac{2}{3}$, *three*-thirds by $\frac{3}{3}$; one-fourth is represented by $\frac{1}{4}$, *two*-fourths by $\frac{2}{4}$, *three* fourths by $\frac{3}{4}$, *four*-fourths by $\frac{4}{4}$; one-fifth is represented by $\frac{1}{5}$, *two*-fifths by $\frac{2}{5}$, *three*-fifths by $\frac{3}{5}$, *four*-fifths by $\frac{4}{5}$, *five*-fifths by $\frac{5}{5}$; one-twelfth is represented by $\frac{1}{12}$, two-twelfths by $\frac{2}{12}$, *five*-twelfths by $\frac{5}{12}$, *seven*-twelfths by $\frac{7}{12}$, *eight*-twelfths by $\frac{8}{12}$, &c. In these expressions the lower figure shows the *number of parts* into which the thing is divided, and indicates the *fractional unit*, (one-half, one-third, one-fourth, &c.); the upper figure expresses a certain number of these equal parts, or *fractional units*. The thing which is divided into equal parts may be called the UNIT OF THE FRACTION.

2. How many halves in 1 thing? in 2 things? in 3 things? in 2 dollars and one-half? in 3 pounds and one-half? in 5 feet and one-half? in 6 acres and $\frac{1}{2}$ of an acre?

3. How many fourths in 4?

Ans.—In 1 there are 4 fourths, therefore in 4 there are 4 times as many, that is, 16 fourths.

4. How many fifths in 5? in 8? in 12? How many sevenths in 3? in 5? in 10? in 11? in 12? in 13?

5. Of what number is 2 the one-third? 4 the one-fourth? 5 the $\frac{1}{5}$? 10 the $\frac{1}{10}$?

6. Of what number is 12 the $\frac{1}{5}$? $\frac{1}{7}$? $\frac{1}{8}$? Of what number is $\frac{2}{5}$ the $\frac{3}{4}$? the $\frac{1}{5}$? the $\frac{1}{6}$?

7. Charlie is 5 years old, and his age is $\frac{1}{8}$ his father's age: How old is his father?

8. How many ninths in 8? in 9? in 10? Show that three-tenths of one=*one*-tenth of three. That $\frac{3}{4}$ of $1=\frac{1}{4}$ of 3.

9. What is the fractional unit in $\frac{3}{4}$? in $\frac{7}{8}$? in $\frac{9}{10}$? in $\frac{11}{20}$? in $\frac{5}{17}$? in $\frac{7}{40}$? in $\frac{15}{91}$? in $\frac{17}{100}$? in $\frac{21}{250}$? in $\frac{119}{300}$?

10. How many fractional units in $\frac{11}{20}$? in $\frac{8}{15}$? in $\frac{23}{50}$? in $\frac{81}{100}$? in $\frac{150}{181}$? in $\frac{575}{991}$? What is the UNIT OF THE FRACTIONS in \$$\frac{3}{4}$? £$\frac{4}{5}$? $\frac{4}{7}$ acre? $\frac{5}{9}$ mile? $\frac{3}{8}$ ton?

11. What are all the fractional units, as far as 20? What is the fractional unit corresponding to the number 16? to 30? to 45? to 49? to 50? to 500?

12. Willie gave away $\frac{1}{3}$ of an apple: how many thirds had he left? How many eighths of a yard in a yard? How many tenths of a dollar in a dollar? How many sixteenths of a pound in a pound?

13. How much does $\frac{3}{5}$ lack of 1? How much does $\frac{5}{7}$ lack of 1? How many twentieths must be added to $\frac{9}{20}$ to make it equal to 1?

14. Take $\frac{5}{9}$ from 1 and what is left? Take $\frac{4}{13}$ from 1 and what is left?

15. Which is the greater, one-half or one-third? One-sixth or one-fifth? One ninth or one-twelfth? One twentieth or one-thirtieth?

16. A horse cost \$100, and a sleigh $\frac{3}{5}$ as much: Find the cost of the sleigh.

17. A man sold $\frac{4}{9}$ of a piece of cloth which contained 45 yards: How many yards were left?

18. If A can dig a ditch in twelve days, what part of it can he dig in 1 day? in 5 days? in 7 days?

19. If B can dig a ditch in 10 days, what part of it can he dig in one day? in 5 days? in 9 days?

20. If a person leaves his property, worth $1800, to his wife and 8 children, in equal parts, what fraction of the whole will each have, and how many dollars?

21. What is the $\frac{1}{9}$ of 18? of 18 shillings? of 18 pence? of 18 days? of 45 farthings? of 45 hours. What is the $\frac{1}{12}$ of 36 seconds? of 36 ounces? of 36 tens? of 36 tenths? of 36 twelfths? of 36 fiftieths?

22. I owned $\frac{35}{64}$ of a ship, and sold $\frac{1}{7}$ of my share: how many sixty-fourths had I left?

23. If you put up ten pounds of tea in packages of one pound, what part of the whole do you put in one package? in 3 packages? in 7 packages?

24. 1 is what part of 10? of 5? of 15? of 9? One-seventh is what part of 2-sevenths? 4-sevenths? 5-sevenths? 6-sevenths? of 5? of 16? One-nineteenth is what part of $\frac{5}{19}$? $\frac{7}{19}$? $\frac{10}{19}$? $\frac{13}{19}$? $\frac{18}{19}$? 3 is what part of 10?

25. A person having $85, earned $115 more, and then gave away one-fourth of what he had: how much did he give away: how much did he retain?

26. Jane has $\frac{7}{8}$ of a dollar, and Harry and James have each $\frac{5}{8}$ of a dollar: how much more have these than Jane?

27. If 4 pounds of almonds cost 80 cents, what part of 80 cents will one pound cost? 2 pounds? 3 pounds? 5 pounds? 7 pounds? What part of 12 is 7? 9? 15?

28. What is 1-seventh of $\frac{7}{20}$? $\frac{14}{20}$? $\frac{21}{20}$? $\frac{35}{20}$? $\frac{42}{20}$?

29. What is 2-sevenths of $\frac{14}{31}$? 3-sevenths? 5-sevenths? 6-sevenths? 13-sevenths?

30. If 12 oranges cost 36 cents, what part of 36 cents will 1 orange cost ? 2 oranges ? 3 oranges ? 5 oranges ? 8 oranges ?

31. In a certain High School there are 12 boys and $\frac{7}{4}$ as many girls; required the number of girls, and the number in the school.

32. What do you understand by 3-fourths ? 5-sixths ? 7-eighths ? $\frac{9}{10}$? $\frac{13}{20}$? $\frac{15}{32}$?

33. A cow was bought for $60, and was sold for $\frac{7}{8}$ of the cost : what was the gain ?

34. $\frac{5}{12}$ of the number of hours in a day is the number of hours I work , how many hours do I work ?

35. 3-ninths of 18+5-sixths of 18 is how many ? 6-ninths of 54 are how many times $\frac{2}{5}$ of 20 ?

36. 3 sevenths of 21 are how many times 3 ?

Sol.—1-seventh of 21 is 3 ; 3-sevenths of 21 is 9, which is 3 times 3 ; therefore 3 sevenths of 21 is 3 times 3.

37. 3-eighths of 24 are how many times 6 ? 4-fifths of $15 are how many times $3 ? $\frac{4}{5}$ of 15 tenths are how many times 3-tenths ? $\frac{4}{5}$ of 15-twentieths are how many times $\frac{3}{20}$? 7-ninths of 27 are how times 9 ?

38. Fred had $60 ; $\frac{1}{3}$ of it he spent for a watch, and $\frac{1}{4}$ of it for a suit of clothes, how much had he remaining ?

39. A pole whose length is 15 feet is in the air and water, and $\frac{2}{3}$ of the whole length, less 3 feet, is the length in the water, required the length in the air ?

40. The interest on $600 for 6 years is equal to $\frac{1}{5}$ of the principal : how much was the yearly interest ?

41. What will 3-fourths of 8 pounds of coffee cost at 20 cents a pound ?

42. A is worth $2,400, and 5 sixths of A's fortune is 10 times the interest on B's fortune for a year : what is the interest on B's fortune ?

43. A road 160 miles long is composed of 10 equal sections. What fraction of the whole road are 6 of these sections, and how many miles do they contain?

44. If the rent of a house for 30 days is $90, how much will it be for 17 days?

45. The site of a school cost $700; and 4-sevenths of this $100 is 1-eighth of the cost of the building: required the cost of the building?

Section II.—Reduction and Analysis.

Examples.—18.

1. How many fourths in $4\frac{3}{4}$?

Sol.—$4\frac{3}{4}=4+\frac{3}{4}$; in 4 there are 16 fourths, therefore in $4+\frac{3}{4}$ there are 16 fourths+3 fourths, or 19 fourths, that is $\frac{19}{4}$.

2. How many thirds in $3\frac{1}{3}$? $4\frac{2}{3}$? $5\frac{1}{3}$? $6\frac{2}{3}$? $13\frac{1}{3}$?

3. How many fifths in $4\frac{1}{5}$? $3\frac{3}{5}$? $7\frac{4}{5}$? $8\frac{2}{5}$?

4. How many sevenths in $7\frac{1}{7}$? in $8\frac{2}{7}$? in $10\frac{3}{7}$? in $11\frac{5}{7}$?

5. How many ninths in $1\frac{1}{9}$? in $2\frac{2}{9}$? in $4\frac{4}{9}$? in $5\frac{5}{9}$?

6. By how much is $4\frac{5}{8}$ greater than $3\frac{7}{8}$? than $2\frac{5}{8}$?

7. What is the result in $5\frac{5}{11}-1\frac{3}{11}+6\frac{4}{11}-4\frac{6}{11}$?

8. How many tenths in $3\frac{1}{10}$? in $2\frac{2}{10}$? in $4\frac{3}{10}$? in $5\frac{4}{10}$? in $7\frac{7}{10}$?

9. How many twelfths in $2\frac{1}{12}$? in $1\frac{2}{12}$? $3\frac{3}{12}$? in $5\frac{10}{12}$?

10. How, then, are mixed numbers reduced to *improper fractions*?

11. Reduce to improper fractions $3\frac{1}{6}$, $4\frac{3}{7}$, $6\frac{5}{8}$, $5\frac{1}{4}$, $9\frac{7}{8}$, $10\frac{9}{11}$.

12. Reduce to improper fractions $1\frac{9}{10}$, $2\frac{9}{11}$, $3\frac{9}{12}$, $1\frac{9}{13}$, $1\frac{7}{17}$, $1\frac{19}{20}$.

13. How many fourths of a dollar will 7 yards of cloth cost at $\$2\frac{3}{4}$ a yard?

Sol.—$2\frac{3}{4}=\frac{11}{4}$ and 7 times $\frac{11}{4}=\frac{77}{4}$.

14. How many thirds of a dollar will 9 barrels of flour cost at $\$6\frac{2}{3}$ a barrel?

15. What will ten yards of cloth cost at $\$2\frac{2}{3}$ a yard!

16. What will 10 lbs. sugar cost at $6\frac{2}{3}$ cents per pound? at $7\frac{1}{5}$ cents? $5\frac{5}{9}$ cents?

17. What will 7 yards of cloth cost if 2 yards can be bought for $\$6\frac{2}{5}$?

18. If 9 felt hats can be bought for $\$11\frac{1}{4}$, how much will 8 hats cost?

19. If $3\frac{3}{4}$ tons of coal cost $60, what will 4 tons cost at the same rate?

20. How much will 14 lbs. of raisins cost when $3\frac{1}{3}$ lbs. cost 50 cents?

21. $2\frac{2}{7}$ yards of muslin cost 48 cents: what will 10 yards cost at the same rate?

Fractions.—Reduction.

UNITS.

EXAMPLES.—19.

1. How many *units* are there in $\frac{7}{2}$?

Sol.—2 halves make one unit, and 7 halves contain 2 halves 3 times with *one*-half remainder ∴ in $\frac{7}{2}$ there are $3\frac{1}{2}$ units.

2. How many units in $\frac{5}{2}$? in $\frac{9}{2}$? in $\frac{19}{2}$? in $\frac{4}{3}$? in $\frac{11}{3}$? in $\frac{17}{3}$?

3. How many units in $\frac{28}{7}$? in $\frac{84}{7}$? in \$$\frac{15}{7}$? in £$\frac{22}{7}$?

4. How many units in $\frac{27}{8}$? in $\frac{32}{9}$? in $\frac{37}{9}$? in $\frac{94}{10}$? in $\frac{99}{10}$?

5. How, then, may any *improper fraction* be reduced to a mixed number?

6. Reduce to mixed numbers $\frac{11}{4}$, $\frac{22}{4}$, $\frac{29}{4}$, \$$\frac{49}{4}$, £$\frac{13}{5}$; $\frac{17}{5}$ shillings, $\frac{63}{5}$. Reduce to mixed numbers $\frac{37}{7}$ pence, $\frac{48}{7}$ hours, $\frac{75}{7}$ seconds, $\frac{82}{10}$ farthings, $\frac{89}{10}$, $\frac{129}{10}$, $\frac{42}{11}$, $\frac{135}{11}$

7. At \$$6\frac{3}{4}$ a barrel, what will 12 barrels of flour cost?

8. If 2 dozen of eggs cost $28\frac{2}{3}$ cents, what will 3 dozen cost?

9. I paid \$9 for $2\frac{1}{4}$ barrels of apples, what will $5\frac{1}{2}$ barrels cost at the same rate?

10. If $\frac{4}{5}$ of a pound of tea cost 48 cents, what will 1 lb. cost? 2 lbs.? 3 lbs.? 4 lbs.? $3\frac{1}{2}$ lbs.? $4\frac{1}{2}$ lbs.? $5\frac{3}{4}$ lbs.?

11. If $\frac{3}{5}$ of a ton of hay is worth \$$4\frac{4}{5}$, what will $7\frac{2}{3}$ tons cost?

12. A man walks 7 miles in $2\frac{1}{3}$ hours: how far will he walk in $4\frac{2}{3}$ hours?

13. Find the number of bows, each containing $\frac{1}{6}$ of a yard of ribbon, that can be made out of $7\frac{5}{6}$ yards.

14. At a church collection 43 dollars, 24 half dollars, and 32 quarters were received: what was the whole amount?

15. a pint is one eighth of a gallon: how many pints in $13\frac{3}{8}$ gallons? How many gallons in 141 pints?

16. If a boy can split $\frac{4}{9}$ of a cord of wood in a day, how long will he take to split $\frac{1}{9}$ of a cord? $\frac{4}{9}$? 1 cord? 2 cords? 8 cords?

17. How many quarter-pound weights will it take to balance 56 pounds weight? How many half-pound weights?

18. How many lots $\frac{1}{16}$ of an acre in size can be laid out of 5 acres? from 7 acres? from $2\frac{3}{16}$?

19. If a man can do $\frac{1}{5}$ of a piece of work in 2 hours, how long will it take him to do the whole?

20. If a boat is 3 hours in performing $\frac{1}{5}$ of its trip, how long at that rate will its whole trip take?

21. If a locomotive can go six miles in $\frac{1}{5}$ of an hour, how many miles can it go in one hour and a half?

22. With \$24 collected from one customer, \$16 from another, and \$11 from a third, a person paid $\frac{3}{5}$ of his taxes: what did his taxes amount to?

23. $7+8+5+4$ is $\frac{1}{3}$ of what number? $\frac{7}{12}+\frac{8}{12}+\frac{5}{12}+\frac{4}{12}$ is $\frac{1}{3}$ of what number?

24. 5 is a third of how many times 6? Of what number is $3\frac{1}{3}$ one-seventh? One-ninth? One-twelfth?

25. If a fifth of a yard of carpet cost two-fifth of a dollar, what is that a yard? How much would \$$27\frac{1}{2}$ buy?

26. If a ninth of a pound of raisins cost 2 cents, what will 4 ninths of a pound cost? What will $3\frac{6}{9}$ pounds cost?

27. A man being asked the value of his horse said, \$$\frac{35}{3}$ is one-tenth of its value: what is its value?

28. $9\frac{2}{7}$ is a seventh of what number? $5\frac{3}{4}$ is 1-fourth of what number? $7\frac{7}{9}$ is 1-ninth of what number?

29. 18 is 1-half of 6 times what number?

30. 15 is 1-sixth of 5 times what number?

31. A wagon cost \$$60\frac{3}{4}$, which is 1-fourth the cost of the buggy: what was the cost of the buggy?

32. $7\frac{3}{4}$ is $\frac{1}{4}$ of what number? $\frac{1}{5}$ of what number? $\frac{1}{6}$? $\frac{1}{7}$? $\frac{1}{8}$?

33. A man being asked his age, said his youngest son's age, which was 15 years, was just one-eleventh of 3 times his age: what was his age?

34. A lady's shawl cost $9, which was 1-eighth of 4 times the cost of her dress: what was the cost of the dress?

35. A house cost $800 which was 1-tenth of 4 times the value of the farm on which it stands. Required the value of the farm?

36. 2 thirds of 21+3-fourths of 16, are how many times 7?

37. 3 sevenths of 21+3 eighths of 40, are how many times [illegible]?

38. If $3\frac{1}{3}$ lbs. of butter cost 60 cents, how much can be bought for 360 cents?

39. $\frac{2}{3}$ of 21 is $\frac{1}{2}$ of what number? $\frac{7}{8}$ of what number?

40. 2+8 — 3 is $\frac{1}{4}$ of what number?

41. $\frac{4}{7}$ of 56 are how many times 8?

42. How many fifths in 4? In $4\frac{3}{4}$? How many sevenths in 3? In $3\frac{4}{5}$? How many ninths in 3? In $3\frac{1}{5}$? How many tenths in 4? In $4\frac{3}{8}$? In $2\frac{1}{6}$? In $3\frac{1}{8}$?

Fractions—Reduction, &c.

EXAMPLES.—20.

1. In $\frac{2}{3}$ how many twelfths?

Sol.—In 1 there are 12 twelfths ∴ in $\frac{2}{3}$ there are 2 thirds of 12 twelfths, or 8 twelfths, that is $\frac{8}{12}$.

2. How many sixths in $\frac{1}{2}$? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{5}{2}$?

3. How many eighths in $\frac{1}{2}$? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{2}{4}$? $1\frac{3}{4}$? $3\frac{3}{4}$?

4. How many fifteenths in $\frac{1}{3}$? $\frac{2}{3}$? $2\frac{2}{3}$? $\frac{3}{5}$? $\frac{2}{5}$? $3\frac{2}{5}$? $4\frac{1}{5}$?

5. How many twenty-firsts in $\frac{1}{3}$? $\frac{2}{3}$? $3\frac{2}{3}$? $\frac{2}{7}$? $\frac{5}{7}$? $1\frac{5}{7}$?

6. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, $1\frac{1}{12}$, $2\frac{3}{4}$ to twenty-fourths.

7. Reduce $\frac{4}{9}$, $\frac{2}{3}$, $\frac{3}{4}$, $1\frac{1}{9}$, $2\frac{1}{2}$, $\frac{7}{18}$, $1\frac{1}{18}$, $2\frac{1}{12}$ to thirty-sixths.

8. Since $\frac{4}{9}=\frac{16}{36}$, how may the latter fraction be derived from the former?

9. Since $\frac{16}{36}=\frac{4}{9}$ how may the latter fraction be obtained from the former?

10. How many fifths in $\frac{2}{10}$? $\frac{4}{10}$? $\frac{6}{15}$? $\frac{5}{25}$? $\frac{18}{30}$? $\frac{36}{4}$?

11. How many ninths in $\frac{24}{36}$? $\frac{14}{18}$? $\frac{16}{36}$? $\frac{15}{27}$? $\frac{12}{54}$?

12. How many fourteenths in $\frac{16}{28}$? $\frac{20}{56}$? $\frac{18}{42}$? $\frac{24}{112}$?

13. Reduce to eighths $\frac{4}{16}$, $\frac{32}{64}$, $\frac{16}{48}$, $\frac{63}{72}$, $\frac{70}{80}$.

14. Reduce to their *lowest terms* $\frac{6}{12}$, $\frac{9}{18}$, $\frac{16}{32}$, $\frac{20}{30}$, $\frac{18}{27}$, $\frac{18}{4}$.

15. Reduce to lowest terms $\frac{15}{45}$, $\frac{21}{42}$, $\frac{24}{48}$, $\frac{25}{35}$, $\frac{27}{36}$, $\frac{35}{55}$, $\frac{11}{132}$.

16. Reduce to lowest terms $\frac{25}{75}$, $\frac{36}{84}$, $\frac{75}{100}$, $\frac{45}{90}$, $\frac{56}{48}$, $\frac{81}{27}$.

17. If $2\frac{1}{2}$ barrels of flour cost $20, find the cost of $3\frac{1}{4}$ barrels.

18. John has $40 a month, which is $\frac{5}{4}$ of half of what James has: how much has James?

19. 16 is $\frac{8}{15}$ of three times some number: find $\frac{4}{5}$ of the number.

20. $45 is $\frac{5}{9}$ of A's money, and B has $\frac{2}{3}$ as much as A: how much has each?

21. A horse cost $100, which is $\frac{5}{8}$ of 10 times what the saddle cost: find the cost of the saddle.

22. Reduce $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{3}{16}$ to sixteenths.

23. Reduce $\frac{1}{2}$, $\frac{4}{5}$, $\frac{3}{10}$, $\frac{19}{20}$ to twentieths.

24. Reduce $\frac{3}{8}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{1}{12}$, $\frac{7}{24}$ to twenty-fourths.

25. How, then, may fractions be changed to equal ones having a *common* denominator?

26. Reduce $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, to a common denominator.

27. Reduce $\frac{3}{4}$, $\frac{1}{6}$, $\frac{5}{12}$, $\frac{3}{2}$, $\frac{2}{3}$ " " "

28. Reduce $\frac{2}{5}$, $\frac{7}{10}$, $\frac{3}{4}$, $\frac{5}{20}$ to a common denominator.

29. Reduce $\frac{1}{5}$, $\frac{2}{9}$, $\frac{3}{5}$, $\frac{7}{9}$ “ “ “

30. Reduce $\frac{2}{3}$, $\frac{1}{6}$, $1\frac{1}{6}$, $\frac{5}{9}$ “ “ “

31. Reduce $\frac{1}{12}$, $\frac{4}{15}$, $\frac{7}{10}$, $\frac{1}{6}$ “ “ “

32. Reduce $1\frac{1}{2}$, $2\frac{1}{4}$, $3\frac{3}{4}$, $\frac{5}{8}$ “ “ “

33. Reduce the following mixed numbers to improper fractions: $5\frac{3}{10}$, $7\frac{1}{10}$, $12\frac{1}{3}$, $10\frac{3}{8}$, $20\frac{2}{3}$, $8\frac{7}{9}$, $7\frac{7}{12}$.

34. Change the following to mixed numbers: $\frac{23}{10}$, $\frac{8}{5}$, $\frac{17}{4}$, $\frac{25}{6}$, $\frac{48}{5}$, $\frac{37}{9}$, $\frac{83}{11}$, $\frac{100}{12}$, $\frac{48}{15}$, $\frac{75}{20}$, $\frac{95}{4}$, $\frac{130}{25}$.

35. Reduce to their lowest terms: $\frac{9}{24}$, $\frac{10}{18}$, $\frac{25}{25}$, $\frac{70}{100}$, $\frac{32}{64}$: $\frac{16}{24}$, $\frac{78}{80}$, $\frac{11}{44}$, $\frac{31}{62}$, $\frac{45}{180}$, $\frac{67}{51}$, $\frac{34}{136}$.

36. Harry gave his sister \$40, which was $\frac{4}{5}$ of all he had: how much had he?

37. John being asked his age said: 3 fourths of my present age equals my age five years ago: how old is he?

38. Find the sum of $\frac{1}{4}+\frac{1}{4}+\frac{2}{4}+\frac{5}{4}+\frac{7}{4}$.

39. I gave \$$120\frac{5}{8}$ for a horse, and \$$19\frac{3}{8}$ for a saddle: find the cost of both.

40. Mary says that $\frac{1}{2}$ her present age is $\frac{3}{5}$ of her age three years ago: find her present age.

41. James being asked how much money he had, said: If I had \$20 more, $\frac{3}{5}$ of the sum would be $\frac{9}{10}$ of what I now have: how much had he?

42. What is the result of $\frac{15}{24}-\frac{7}{24}$? $\frac{15}{50}-\frac{7}{50}$? $\frac{15}{71}-\frac{7}{71}$?

43. I owned $\frac{13}{64}$ of a ship, and sold $\frac{4}{64}$ of the ship: what part had I left?

44. John gave $\frac{2}{7}$ of his money to Charles, $\frac{5}{21}$ of it to Ida, and had 20 cents left: how many cents did John and Ida each receive?

Fractions.—Section III.

ADDITION AND SUBTRACTION.

EXAMPLES.—21.

1. John had $\frac{3}{4}$ of a dollar, and his father gave him $\frac{3}{4}$ more: how much had he then?

2. One man had $\frac{2}{5}$ of an acre of land, a second had $\frac{3}{5}$, and a third had $\frac{7}{5}$: how much had they all?

3. Bought a barrel of flour for \$$7\frac{5}{8}$, and a cord of wood for \$$4\frac{7}{8}$: how much did he lay out?

4. Find the result of $\frac{7}{10}+\frac{4}{10}-\frac{5}{10}+\frac{8}{10}-\frac{3}{10}$.

5. Find the sum of $\frac{2}{3}$ and $\frac{3}{4}$.

Sol.—$\frac{2}{3}=\frac{8}{12}$, $\frac{3}{4}=\frac{9}{12}$, and $\frac{9}{12}+\frac{8}{12}=\frac{17}{12}$, or $1\frac{5}{12}$.

6. Find the sum of $\frac{2}{3}$ and $\frac{5}{6}$: of $\frac{3}{4}$ and $\frac{7}{8}$.

7. Find the sum of $\frac{2}{3}$ and $\frac{3}{8}$: of $\frac{2}{5}$ and $\frac{5}{6}$.

8. I had $\frac{2}{5}$ of an acre of land, and bought $\frac{3}{4}$ of an acre: how much had I then?

9. Find the sum of $8\frac{3}{4}+2\frac{1}{2}+3\frac{7}{8}$.

10. Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$. Add $2\frac{1}{2}$ and $3\frac{2}{3}$.

11. Find $\frac{1}{2}+\frac{3}{4}+2\frac{1}{2}+3\frac{1}{4}+7\frac{1}{9}$.

12. Add $\frac{7}{18}$, $\frac{4}{9}$, $\frac{5}{12}$, and $\frac{1}{6}$.

13. Find the sum of $2\frac{1}{2}+3\frac{1}{3}+8\frac{3}{4}+12\frac{1}{6}$.

14. $\frac{1}{2}$ of a number increased by $\frac{3}{8}$ of the number is equal to 70: find the number.

15. Willie being asked how much money he had, said: if the amount were increased by $\frac{5}{7}$ of itself, I should have \$84: how much had he?

16. $\frac{3}{5}$ of A's money increased by $\frac{3}{4}$ of his money, equals \$81: how much had he?

17. A man gave \$80 for a watch, and \$$40+\frac{3}{5}$ of the cost of the watch is 4 times what his chain cost: find its cost.

18. I had $\frac{7}{8}$ of a dollar, and paid $\frac{3}{8}$ of a dollar for a pound of coffee, how much had I left?

19. A man owned $\frac{5}{8}$ of a ship, and sold $\frac{3}{16}$ of the ship: what part had he left?

20. Find the difference between $\frac{1}{2}$ and $\frac{1}{3}$, $\frac{3}{4}$ and $\frac{5}{5}$, $\frac{5}{9}$ and $\frac{7}{18}$.

21. What is the result of $5\frac{7}{8}+8\frac{3}{4}-3\frac{1}{2}$?

22. Subtract $\frac{1}{5}$ from $\frac{1}{4}$, $\frac{1}{8}$ from $\frac{1}{2}$, $\frac{1}{3}$ from $\frac{3}{4}$, $\frac{1}{6}$ from $\frac{1}{4}$.

23. Subtract $\frac{2}{5}$ from $\frac{2}{4}$, $\frac{2}{3}$ from $\frac{4}{5}$, $\frac{3}{4}$ from $\frac{8}{9}$, [illegible] from $\frac{2}{3}$.

24. Subtract $\frac{1}{8}$ from $\frac{1}{7}$, $\frac{2}{7}$ from $\frac{2}{3}$, $2\frac{1}{2}$ from $3\frac{1}{4}$.

25. Subtract $3\frac{1}{5}$ from $4\frac{1}{4}$, $2\frac{1}{4}$ from $3\frac{1}{6}$, $3\frac{1}{5}$ from $5\frac{1}{6}$.

26. What is the result of $\frac{1}{2}+\frac{1}{3}-\frac{1}{4}$? of $\frac{1}{2}+\frac{3}{4}-\frac{1}{3}$?

27. What is the result of $\frac{1}{2}+\frac{1}{6}-\frac{1}{4}$? of $\frac{1}{5}-\frac{3}{10}+\frac{1}{4}$?

28. What is the result of $2\frac{1}{2}+4\frac{1}{5}-4\frac{1}{4}$? of $1\frac{1}{3}+1\frac{1}{4}-2\frac{1}{5}$?

29. What is the result of $3\frac{2}{3}+2\frac{3}{4}-5\frac{1}{2}$? of $2\frac{1}{6}-1\frac{1}{4}+3\frac{1}{3}$?

30. What is the result of $4\frac{2}{5}-4\frac{1}{4}+6\frac{1}{2}$? of $2\frac{1}{6}+2\frac{1}{5}-2\frac{1}{10}$?

31. What is the result of $1\frac{1}{2}+2\frac{2}{3}-3\frac{3}{4}$? of $7\frac{2}{3}-5\frac{1}{2}$?

32. From the sum of $\frac{5}{24}$ and $\frac{17}{24}$ take $\frac{11}{24}-\frac{3}{24}$.

33. Find the value of $3\frac{1}{2}+4\frac{3}{4}-2\frac{1}{3}-1\frac{1}{2}$.

34. A can do a piece cf work in 5 days, and B in 4 days: what portion of the work can both together do in one day? in 2 days? in 3 days?

35. $\frac{2}{9}$ of a post is in the ground, and there are 7 feet of it above ground: find its entire length.

36. The difference between $\frac{2}{3}$ of my money, and $\frac{4}{9}$, of it, is $\$16\frac{2}{3}$: how much have I?

37. Bought a coat for $\$11\frac{5}{16}$, and a vest for $\$5\frac{1}{2}$, and handed in payment 2 ten dollar bills : how much change did I receive?

38. From $18\frac{1}{3}$ subtract $7\frac{5}{6}$.

Sol.-- $18\frac{1}{3}-7\frac{5}{6}=18\frac{2}{6}-7\frac{5}{6}=17+1\frac{2}{6}-7\frac{5}{6}$
$=17-7+\frac{8}{6}-\frac{5}{6}=10\frac{3}{6}=10\frac{1}{2}$.

39. Find the results of $4\frac{3}{7}-\frac{7}{9}$, of $12-6\frac{9}{14}$, of $36\frac{1}{2}-24\frac{5}{8}$.

40. I bought two articles, one costing $\$15\frac{7}{8}$, the other $\$20\frac{1}{3}$, and gave in payment a \$50 bill : how much change did I receive?

41. $\frac{4}{15}$ of the candidates at an examination failed in arithmetic, $\frac{3}{5}$ in other branches, and 20 passed : how many candidates were there?

42. How do you add two or more simple fractions? two or more mixed numbers?

43. How do you find the difference between two simple fractions? between two mixed numbers?

Fractions—Addition, &c.

EXAMPLES.—22.

1. A can do a work in 4 days and B the same work in 5 days : what part of the work can both together do in one day?

2. John can do a piece of work in $1\frac{3}{4}$ days and James in $2\frac{1}{3}$ days : what part of the work can both do in a day?

3. A grocer sold $\frac{1}{2}$ dozen of oranges to one man, $\frac{1}{3}$ of a dozen to another, and $\frac{5}{6}$ of a dozen to a third, aad had $3\frac{1}{3}$ dozen left : how many dozen had he at first?

4. Sold $\frac{3}{5}$ of an acre of land to one man, $\frac{2}{3}$ to another, and $\frac{7}{15}$ to a third: how much did I receive at 60 cents an acre?

5. A can do $\frac{1}{3}$ of a piece of work in a day, B $\frac{1}{4}$ and C $\frac{1}{5}$: how much can all three do in a day?

6. If a boy who had \$$4\frac{1}{4}$, earned \$$2\frac{3}{8}$ more, and had \$$1\frac{1}{10}$ given him, how many dollars had he then?

7. If a person buy a razor for $\frac{3}{4}$ of a dollar and a strap for $\frac{6}{8}$ of a dollar, for how much must he sell them both in order to make half a dollar?

8. If 6 is $\frac{2}{3}$ of some number, what is $\frac{1}{3}$ of 3 times the some number?

9. 8 is $\frac{2}{3}$ of some number: what is $\frac{3}{4}$ of the same number?

10. Henry's horse cost 90 dollars, which is $\frac{9}{10}$ of 5 times the cost of the cart: required the cost of the cart.

11. A watch cost \$90, which is $\frac{3}{9}$ of 10 times what the chain cost: required the cost of both.

12. What number added to $\frac{3}{4}$ will make $\frac{7}{8}$?

13. A gave 48 cents, and $\frac{5}{6}$ of this is 4 times as many as he had remaining: how much had he at first?

14. Jane having 50 pins, lost $\frac{4}{5}$ of them and then found as many as remained: how many had she then?

15. What fraction is that which exceeds $\frac{5}{18}$ by $\frac{5}{54}$?

16. What number is that from which if $4\frac{4}{5}$ be taken, the remainder will be $3\frac{22}{35}$?

17. A beggar met four persons; from the first he obtained $\frac{1}{8}$ of a dollar, from the second $\frac{1}{6}$, from the third $\frac{1}{5}$, and from the fourth $\frac{2}{15}$: how much did he get from all?

18. Thomas spends $6\frac{1}{4}$ cents for sweets, $12\frac{1}{2}$ cents for a top, and $5\frac{1}{2}$ cents for a slate: what did they all cost?

19. James spent $\frac{4}{5}$ of a dollar for a book, $\frac{7}{8}$ of a dollar for half of a ream of paper, and had $\frac{3}{4}$ of a dollar left how much had he at first?

20. A man paid $2\frac{1}{2}$ dollars for a hat, $3\frac{1}{2}$ for a vest and $9\frac{1}{2}$ for a coat: what did the whole cost?

21. A man travels $2\frac{1}{5}$ miles the first hour, $3\frac{1}{4}$ miles the second, and $4\frac{1}{2}$ the third: how far did he travel in the three hours?

22. The sum of two numbers is $16\frac{3}{5}$, and the less is $4\frac{3}{10}$: what is the greater?

23. What number must be added to the sum of $3\frac{1}{2}$, $2\frac{3}{10}$, to make $10\frac{9}{20}$?

24. What number is that which added to the sum of $\frac{1}{8}$, $\frac{1}{12}$, and $\frac{1}{18}$ will make $\frac{25}{36}$?

25. A grocer, having a bushel of potatoes, sold $\frac{1}{4}$ of it to one customer, $\frac{1}{8}$ to another, and $\frac{3}{16}$ to a third · what part remained unsold?

26. What number added to the sum of $2\frac{1}{3}$ and $3\frac{3}{4}$ will make the result a whole number?

27. A stage, after making $\frac{1}{4}$ and $\frac{2}{5}$ of its trip, had 7 miles yet to go: how long was its trip?

28. From two remnants of calico, containing respectively $4\frac{3}{4}$ and $8\frac{7}{8}$ yards, were cut $12\frac{11}{16}$ yards for a dress: how much did what was left lack of a yard?

29. Bought some paper for \$$12\frac{18}{100}$, sold it for \$$13\frac{1}{20}$: by how much did the cost exceed the profit?

30. A can do a piece of work in 12 days, and B in 8 days: what part can each do in one day? How much can both together do in 3 days. After they have worked 2 days, how much will then remain to be done?

31. E can do a certain job in 9 hours, and F in 6 hours. After they have worked together at it one hour and a half, what part of the job remains to be done?

32. A can do a piece of work in 6 days, B in 8, and C in 12 : how much more work does A do in a day than B, and B than C ?

33. $\frac{2}{3}$ of a certain number increased by $\frac{3}{4}$ of the same number, equals 34 : required the number ?

34. A certain sum of money diminished by its $\frac{1}{2}$ and $\frac{1}{3}$, equals \$15 : required the sum.

35. What number is that which diminished by its $\frac{2}{5}$, equals 36 ?

36. Find the difference between $9+12\frac{5}{7}$ and $8\frac{2}{5}+4\frac{1}{7}$.

37. If $\frac{3}{4}$ of James's age increased by $\frac{1}{2}$ and $\frac{1}{3}$ of his age equals 57 years, what is his age ?

38. $\frac{4}{5}$ of B's money increased by the difference between $\frac{3}{5}$ and $\frac{3}{4}$ of his money equals 190 dollars: required his money.

39. \$40 is 4 times what A paid for a chain, and the cost of the chain, increased by its 11 tenths, is $\frac{1}{4}$ of the cost of his watch : required the cost of the watch.

Section IV.—Multiplication.

Examples.—23.

1. What is $\frac{1}{2}$ of $\frac{1}{4}$?

Sol.—$\frac{1}{4}=\frac{2}{8}$, and $\frac{1}{2}$ of $\frac{2}{8}=\frac{1}{8}$ $\therefore$ $\frac{1}{2}$ of $\frac{1}{4}=\frac{1}{8}$ (or $\frac{1\times1}{2\times4}$).

What is $\frac{2}{5}$ of $\frac{3}{4}$?

Sol.—$\frac{3}{4}=\frac{15}{20}$ 1 fifth of this is $\frac{3}{20}$, and 2 fifths is $\frac{6}{20}$ $\therefore$ $\frac{2}{5}$ of $\frac{3}{4}=\frac{6}{20}$ (or $\frac{2\times3}{5\times4}$).

2. Find the result of $\frac{1}{3}$ of $\frac{1}{5}$, $\frac{1}{4}$ of $\frac{1}{4}$, $\frac{1}{5}$ of $\frac{1}{5}$, $\frac{3}{5}$ of $\frac{1}{5}$, $\frac{3}{4}$ of $\frac{8}{15}$, $\frac{1}{6}$ of $\frac{1}{12}$.

3. Find the result of $\frac{1}{2}$ of $2\frac{1}{2}$, $\frac{2}{7}$ of $\frac{14}{29}$, $\frac{1}{6}$ of $\frac{6}{17}$, $\frac{8}{9}$ of $4\frac{1}{2}$

4. I owned $\frac{3}{8}$ of a ship and sold $\frac{2}{3}$ of my share : what part of the ship did I sell ?

5 $\frac{5}{7}$ of $\frac{14}{25}$ of \$50 is $\frac{2}{15}$ of the cost of a watch: find its cost?

6. Find the result of $\frac{2}{3}$ of $\frac{3}{4}$ of $2\frac{4}{7}$, of $\frac{5}{6}$ of $2\frac{2}{5}$.

7. $\frac{5}{14}$ of the candidates at an examination failed in English grammar, $\frac{2}{9}$ of the remainder failed in geography, and 10 passed: how many candidates were there?

8. An orchard has 60 fruit trees, $\frac{5}{12}$ of these are apple trees, and $\frac{3}{7}$ of the remainder are pear trees, and the rest are cherry trees: find the number of each kind.

9. John's age is $\frac{3}{4}$ of Henry's, and the difference of their ages is 4 years: find the age of each.

10. Find the results of $\frac{2}{5}$ of $\frac{3}{15}$ of $\frac{5}{6}$, of $\frac{3}{7}$ of $\frac{14}{9}$, of $\frac{2}{7}$ of $3\frac{3}{4}$.

11. I paid \$500 for a building lot, and $\frac{9}{10}$ of its price is $\frac{1}{4}$ of the cost of the house built on it: find the cost of the house.

12. How many is 3 times $\frac{1}{3}$? $\frac{2}{3}$? $\frac{4}{3}$? $\frac{5}{7}$? $\frac{6}{7}$? $\frac{8}{9}$?

13. How many is 7 times $\frac{2}{7}$? $\frac{3}{7}$? $\frac{3}{8}$? $\frac{5}{9}$? $\frac{7}{10}$? $\frac{5}{21}$?

14. How many is 8 times $\frac{12}{24}$? 9 times $\frac{3}{17}$? 10 times $\frac{13}{40}$?

15. How many is 11 times $\frac{2}{11}$? $\frac{5}{12}$? $\frac{7}{22}$? $\frac{15}{132}$? $1\frac{3}{22}$?

16. Multiply $\frac{2}{5}$ by $\frac{3}{4}$.

Sol.—$\frac{2}{5}\times 3=\frac{6}{5}$; $\frac{3}{4}$ is the $\frac{1}{4}$ of $3 \therefore \frac{2}{5}\times\frac{3}{4}$ is $\frac{1}{4}$ of $\frac{6}{5}=\frac{6}{20}=\frac{3\times 2}{4\times 5}$.

EXAMPLES.—24.

1. If a family consume $\frac{2}{5}$ of a barrel of flour in 1 week, how much will it consume in 6 weeks?

2. What will cost 6 yards of cloth, at $\frac{4}{9}$ of a dollar a yard?

3. At $\frac{4}{3}$ of a cent a piece, what will 12 eggs cost?

4. If a man earns $\frac{3}{4}$ of a dollar in a day, how much will he earn in 12 days?

5. 5 times 4 and $\frac{3}{4}$ of 4 are how many?

6. What will $5\frac{3}{4}$ barrels of flour cost, if a barrel cost $\$4$?

7. 7 times 6 and $\frac{4}{6}$ of 6 are how many?

8. If a barrel of flour cost $\$6$, what will $7\frac{2}{3}$ barrels cost?

9. At $6\frac{1}{3}$ cents, what cost 9 pounds of rice? 12 pounds? 15? 18?

10. If a peck of corn cost $\frac{3}{16}$ of a dollar, how much will 2 bushels cost?

11. Find the cost of 20 bushels of wheat, at $\$2\frac{1}{5}$ a bushel? At $\$2\frac{1}{4}$?

12. How many are 4 times $2\frac{1}{2}$? 6 times $3\frac{2}{3}$?

13. How many are 8 times $5\frac{3}{4}$? 9 times $5\frac{2}{3}$?

14. If a horse can trot $9\frac{3}{4}$ miles in 1 hour, how far at that rate can he trot in 8 hours?

15. How much can be earned in a year at $\$11\frac{2}{3}$ a month? At $\$10\frac{3}{4}$ a month?

16 If 8 men can do a piece of work in $3\frac{1}{4}$ days, how long will it take 1 man to do the work?

17. If $\frac{1}{6}$ of a bushel of oats is worth $\$\frac{1}{8}$, what is a bushel worth?

Analysis.—If $\frac{1}{6}$ of a bushel of oats is worth $\$\frac{1}{8}$, $\frac{6}{6}$ or 1 bushel is worth 6 times $\$\frac{1}{8}$, which is $\$\frac{6}{8}$ or $\$\frac{3}{4}$.

18. When $\frac{1}{4}$ of a barrel of flour is worth $\$1\frac{5}{8}$, what is a barrel worth?

19. If a man can reap $\frac{7}{16}$ of an acre in $\frac{1}{2}$ of a day, how much can he reap in a day?

20 If $\frac{1}{3}$ of a melon is worth as much as $6\frac{2}{5}$ apples, how many apples are worth as much as 1 melon?

21. $5\frac{1}{6}$ is $\frac{1}{9}$ of what number? $\frac{1}{10}$ of what number? $\frac{1}{12}$ of what number?

22. 5 times $2\frac{1}{10}$ is $\frac{1}{2}$ of what number ?

23. 2 times $3\frac{5}{8}$ is $\frac{1}{3}$ of what number ?

24. If 20 pipes of a certain size can fill a cistern in $\frac{9}{10}$ of an hour, in how long will a single pipe $\frac{1}{3}$ as large as each of them, fill the same cistern ?

25. Two and 3-fifths, is one-fifth of what number ?

26. One and 3-sevenths, is one-eighth of what number ?

27. If the current of a river be $\frac{9}{10}$ of a mile an hour, how far would it carry a boat in 8 hours ?

28. How many are 5 times $3\frac{2}{7}.\times\frac{2}{7}$?

29. How many are 8 times $12\frac{5}{7}-\frac{5}{7}$?

30. How many are 9 times $10\frac{3}{4}-\frac{3}{4}$?

31. 7 times 20 and $\frac{3}{5}$ of twenty are how many ?

32. Multiply $4\frac{1}{2}$ times 10 by $\frac{2}{5}$ of 15 ?

33. Multiply 2 times $9\frac{1}{6}$ by $2\frac{1}{4}$ times 4 ?

34. Emma is $3\frac{3}{4}$ years old, Laura is 5 times as old as Emma. In how many years will Laura be 21 ?

35. What two ways are there of multiplying a fraction by a whole number ?

Division.

EXAMPLES.—25.

1. Divide $\frac{4}{7}$ by 2.

Sol.—If we divide 4 units of any kind by 2, we get 2 units of the *same kind*, therefore 4-sevenths divided by 2 give 2-sevenths, that is $\frac{2}{7}$.

2nd Sol.—To divide anything by 2 is to take $\frac{1}{2}$ of it, and $\frac{1}{2}$ of $\frac{4}{7}=\frac{4}{14}=\frac{2}{7}$.

2. Divide $\frac{3}{4}$ by 3, $\frac{4}{11}$ by 4, $\frac{10}{13}$ by 5, $\frac{18}{23}$ by 6, $\frac{28}{31}$ by 7, $\frac{72}{63}$ by 9.

3. Find the quotients in the following cases: $\frac{2}{3} \div 3$, $\frac{3}{4} \div 5$, $\frac{7}{8} \div 6$, $2\frac{1}{2} \div 4$, $3\frac{3}{4} \div 7$, $8\frac{1}{2} \div 34$.

4. Since $\frac{4}{7} \div 2 = \frac{2}{7}$, or $\frac{4}{14}$, what are the two ways of dividing a fraction by an integer?

5. If 100 lbs. of flour cost $4, how much can be bought for $\$\frac{4}{5}$? how much for 7 dimes? for 60 cents?

6. I gave $\$3\frac{3}{4}$ for silk at $4 a yard: how much did I buy?

7. Divide 4 by $\frac{3}{5}$.

Sol.—In 4 there are 20 fifths, and 20 units of any kind divided by 3 of the same kind $= \frac{20}{3} = 6\frac{2}{3}$.

8. How many times is $\frac{1}{8}$ contained in $3\frac{1}{2}$? in $4\frac{1}{2}$? in $5\frac{3}{4}$? in $6\frac{2}{3}$.

9. Find the quotients in $3 \div \frac{1}{2}$, $4 \div \frac{3}{4}$, $5 \div \frac{4}{9}$, $4\frac{1}{7} \div \frac{3}{7}$.

10. If a yard of cotton costs $\frac{2}{3}$ of a shilling, how much can be bought for 6 shillings? for 8? for 10?

11. If a man can earn $\frac{4}{5}$ of a dollar in $\frac{3}{4}$ of a day, in how many days can he earn $10?

12. Find the quotients in $2\frac{1}{7} \div \frac{1}{13}$, $1\frac{6}{7} \div \frac{2}{13}$, $1\frac{4}{13} \div \frac{9}{13}$.

13. How much will 10 boxes of herring cost, if $3\frac{1}{3}$ boxes cost $\$5\frac{1}{4}$?

14. 3 men can do a work in $6\frac{2}{3}$ days: how long will it take 12 men to do it?

15. If $3\frac{1}{2}$ barrels of apples cost $14, how many barrels can be bought for $20?

16. If John can walk $2\frac{1}{2}$ miles in $\frac{3}{4}$ of an hour, how far can he walk in 3 hours? in $5\frac{1}{4}$ hours?

17. A man paid $30 for a piece of linen, at $\$\frac{4}{5}$ per yard: how many yards were there?

18. How often is $\frac{3}{4}$ gallon contained in 7 gallons? $\frac{5}{7}$ week in 8 weeks? $\frac{3}{4}$ penny in 9*d*? $\frac{2}{3}$ of a mile in 4 miles? $\frac{2}{3}$ of an inch in $1\frac{1}{2}$ feet?

19. If $\frac{3}{4}$ bushel of potatoes will last a family 6 days, how long will 3 bushels last them?

20. Divide $\frac{3}{4}$ by $\frac{2}{5}$.

1st Sol.—The *divisor* is fifths; and the dividend reduced to fifths $=\frac{3}{4}\times 5=\frac{15}{4}$ fifths and $\frac{15}{4}$ units of any kind, divided by 2 units of the same kind $=\frac{1}{2}$ of $\frac{15}{4}=\frac{15}{8}$, which may be got by multiplying $\frac{3}{4}$ by $\frac{5}{2}$.

2nd Sol.—$\frac{3}{4}=\frac{15}{20}$ and $\frac{2}{5}=\frac{8}{20}$; but 15 units of any kind divided by 8 units of the same kind $=\frac{15}{8}$ $\therefore \frac{3}{4}$ (or $\frac{15}{20}$) divided by $\frac{2}{5}$ (or $\frac{8}{20}$) $=\frac{15}{8}$ (or $\frac{3}{4}\times\frac{5}{2}$).

21. How many times is $\frac{2}{7}$ contained in $\frac{8}{5}$? $\frac{3}{8}$ in $\frac{4}{9}$? $\frac{4}{5}$ in $\frac{8}{9}$? $\frac{5}{9}$ in $\frac{11}{6}$? $\frac{5}{8}$ in $\frac{25}{16}$? $\frac{7}{12}$ in $4\frac{2}{3}$?

22. How many bags of oats can be bought for $\frac{5}{4}$ dollars, at $\frac{2}{3}$ of a dollar a bag?

Analysis.—As many bags can be bought for $\frac{5}{4}$ dollars, as $\frac{2}{3}$ of a dollar is contained times in $\frac{5}{4}$ dollars; $\frac{2}{3}$ is contained in $\frac{5}{4}$, $\frac{15}{8}$ times $=1\frac{7}{8}$: therefore $1\frac{7}{8}$ bags of oats can be bought for $\frac{5}{4}$ dollars.

23. If a man can mow $\frac{7}{8}$ of an acre in an hour, how long will it take him to mow $\frac{5}{8}$ of an acre?

24. At $\frac{2}{5}$ of a dollar each, how many knives can be bought for $1\frac{3}{5}$ dollars?

25. If a horse can run $\frac{3}{8}$ of a mile in 1 minute, how many minutes would he require to run $\frac{5}{6}$ of a mile?

26. If John saves $\frac{2}{5}$ of a dollar, and James $\frac{1}{2}$ of a dollar in a week, how long, at that rate, would it take them to save $1\frac{1}{2}$ dollars?

27. How many yards of cloth at \$$1\frac{1}{2}$ a yard can be bought for \$$2\frac{1}{2}$?

28. If a horse eat $\frac{3}{8}$ of a peck of oats in a day, how long will $3\frac{1}{6}$ pecks last him?

29. A yacht was hired for $10\frac{1}{2}$ dollars a day; if each person paid $\frac{3}{8}$ of a dollar, how many persons were there in the company? If each were charged $\frac{7}{8}$ of a dollar, how many then in the company?

30. In order to raise $6\frac{7}{8}$ dollars, how many contributors must there be at $\frac{5}{16}$ of a dollar? at $\frac{5}{8}$ of a dollar each?

31. If a miller takes for toll, $\frac{6}{25}$ of a bushel of every bushel of wheat that he grinds, how many bushels must he grind, that he may receive $9\frac{2}{9}$ bushels?

32. If the cars run $\frac{2}{5}$ of a mile a minute, how long will it take them to run 25 miles?

33. If a man walks $\frac{4}{5}$ of a mile in $\frac{1}{3}$ of an hour, how long will it take him to walk 12 miles?

34. A boy having 12 quarts of berries, sold $\frac{2}{3}$ of them for $\$\frac{4}{5}$: what was that a quart?

35. Amongst how many boys can you divide $\frac{3}{4}$ of $1\frac{2}{3}$ oranges, if you give $\frac{1}{2}$ of $\frac{1}{4}$ of an orange to each?

36. If a turkey cost $\$1\frac{3}{8}$, how many can be bought for $9?

37. How many times will $4\frac{3}{4}$ gallons of oil fill a lamp that holds $\frac{1}{2}$ of $\frac{2}{3}$ of 1 gallon?

38. If a stage run $24\frac{3}{4}$ miles in $3\frac{1}{2}$ hours, how far does it run in one hour?

39. Bought $\frac{2}{3}$ of $4\frac{1}{2}$ cords of wood for $\frac{1}{9}$ of 54 dollars, what did it cost a cord?

40. Divide $\frac{3}{4}$ of $\frac{1}{2}$ of 14 by $\frac{2}{5}$ of $3\frac{1}{2}$.

41. A farmer divided $213\frac{1}{3}$ acres of land among his three sons; to the first he gave $\frac{2}{5}$ of it, and the remainder he divided equally between the other two: how many acres did each receive?

42. A farmer bought $\frac{3}{5}$ of a farm which was $\frac{2}{3}$ of what his neighbor bought : what part of a farm did his neighbor buy?

43. Divide \$42 in dollars, half dollars, and quarter dollars, and of each an equal number?

44. How many gallons, quarts and pints, and of each an equal number, are there in 44 gallons?

45. A man met some beggars, giving to the women 20 cents each, the boys 10 cents each, the girls 5 cents each. He gave to all \$3.50 : how many beggars were there?

EXAMPLES.—26.

1. What part of 3 is 1? of 3 is 2?

Sol.—1 is $\frac{1}{3}$ of 3 ∴ 2 is $\frac{2}{3}$ of 3.

2. What part of 7 is 1? of 6 is 2? of 9 is 7?

3. What part of 8 units of any kind is 9 units of the same kind? of 11 is 5? of 12 is 4?

4. What part of $\frac{2}{3}$ is $\frac{3}{4}$?

Sol.—$\frac{2}{3}=\frac{8}{12}$ and $\frac{3}{4}=\frac{9}{12}$, because 1 twelfth is $\frac{1}{8}$ of 8 twelfths ∴ 9 twelfths is the $\frac{9}{8}$ of 8 twelfths

5. What part of $\frac{3}{4}$ is $\frac{1}{5}$? of $\frac{3}{4}$ is $\frac{1}{6}$? of $\frac{7}{8}$ is $\frac{2}{3}$? What part of $\frac{6}{7}$ is $\frac{5}{3}$? of $\frac{3}{5}$ is $\frac{4}{15}$? of $\frac{7}{9}$ is $\frac{3}{5}$?

6. What part of 5 is $\frac{2}{3}$? of $3\frac{1}{2}$ is 3? of $4\frac{2}{9}$ is 6?

7. What part of $\frac{7}{10}$ is 6? of $\frac{3}{8}$ is 4? of $\frac{5}{8}$ is $3\frac{1}{2}$?

8. What part of a foot is 4 inches? $3\frac{1}{2}$ inches? and $9\frac{3}{4}$ inches?

9. What part of a mile is 140 rods? is 160 rods?

10. What part of an hour is 15 minutes? is 40 min.

11. What part of 10 miles is $\frac{3}{4}$ of 8 miles? is 2*s.* 6*d.* of £2.5*s.*?

12. A man having \$12, gave \$$2\frac{1}{2}$ for a hat and \$$3\frac{1}{2}$ for a pair of boots : what part of his money did he use?

13. If the interest on $100 is $4, what part of the principal is the interest ?

14. If a man buys a horse for $60, and sells him for $75, what part of his outlay is he gaining ?

15. If a vessel sail 60 miles in 5 hours, what part of 240 miles will she sail in 9 hours ?

16. One man walks $4\frac{1}{2}$ miles while another walks $3\frac{1}{2}$: what part of the distance that the first walks does the second walk ?

17. What part of $3\frac{1}{2}$ acres is $\frac{1}{4}$ of $4\frac{1}{2}$ acres ? of $1\frac{1}{2}$ gallons is 1 qt. 1 pt. ?

18. A merchant gained on a hogshead of sugar $\frac{4}{5}$ of $46\frac{2}{3}$ dollars, which was $\frac{1}{3}$ of two times what it cost him : what did it cost him ? what part of the cost was the gain ?

19. John earns 9 cents as often as James earns 12 ; when John has earned 63 cents, how much has James earned ?

20. Two men start from different points and travel towards each other, the first travels 5 miles while the other travels 3 miles, and when they meet the first has travelled 20 miles more than the other : how far apart were they when they started ?

21. If 4 men can do a piece of work in 8 days, how many men can do a piece of work 6 times as great in half of the time ?

22. If 5 horses eat $1\frac{1}{2}$ tons of hay in 1 month, how many tons will six horses eat in $2\frac{2}{3}$ months ?

28. How many days will it take 5 men to earn $\$11\frac{2}{3}$, if 3 men earn $\$\frac{7}{8}$ in $\frac{1}{4}$ of a day ?

24. Reduce 1 year and 4 months to the fraction of a year.

25. Reduce 1 year and 3 months to the fraction of a year.

26. Reduce 2 years and 5 months to the fraction of a year. 3 years and 10 months to the fraction of a year.

27. 5 years 9 months to the fraction of a year. 4 years and 8 months to the fraction of a year

28. Reduce 5 years 7 months to the fraction of a year.

29. Reduce 9 years 11 months to the fraction of a year.

30. Reduce 2 years 4 months 15 days to the fraction of a year of 360 days.

31. Reduce 4 years 6 months 6 days to the fraction of a year?

32. Reduce 5 years 9 months and 18 days to the fraction of a year.

33. What part of a barrel of potatoes at \$$6\frac{7}{8}$ for 2 barrels, can be bought for \$$3\frac{1}{4}$?

34. A carter drew $13\frac{3}{4}$ tons of freight, taking $1\frac{3}{8}$ ton at a load: how many loads did he draw?

35. If \$100 gain \$6 in one year, what part of the principal is the interest? If the time is a year and 4 months, what part of the principal would be the interest?

36. If \$100 stock be bought for \$98 in money, what fraction of your outlay are you gaining, if the dividends are 8 per cent?

37. When mackerel are at \$$9\frac{3}{4}$ a barrel, how much can be bought for \$$2\frac{1}{4}$?

38. If $\frac{2}{3}$ of 9 were 5, what would $\frac{1}{6}$ of 18 be?

39. If the principal is \$44 and the interest \$4, what fraction of the principal represents the interest.

40. If a merchant buys clover seed at \$6 a bushel and sells it at \$8, what fraction is his gain of his outlay, and what would be his gain on \$100 outlay?

41. If 3 be made 4, what should 100 be made to be in the same ratio?

42. If a merchant buys tea at 60cts. a pound and sells it at 80cts. a pound, what fraction of his outlay is his gain, and what is his gain on \$100 outlay?

43. If a broker buys \$100 stock for \$75 cash, the stock yielding 5 per cent., what fraction of his outlay is his gain, and what is his gain on \$2000 outlay?

44. What fraction is $\frac{3}{4}$ of $\frac{5}{9}$? of $\frac{2}{5}$ is $\frac{3}{10}$? of $\frac{2}{3}$ is $\frac{7}{12}$?

45. If $\frac{2}{3}$ of a certain number is $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of 8, what is the number?

Section V.—Analysis

EXAMPLES—27.

1. If 4 bbls. of apples cost \$$14\frac{2}{5}$, what will $\frac{5}{12}$ of a bbl. cost?

Sol.—4 bbls. cost \$$\frac{72}{5}$, 1 costs $\frac{1}{4}$ of $\frac{72}{5}=\frac{18}{5}$ $\therefore$ $\frac{5}{12}$ costs $\frac{5}{12}$ of $\frac{18}{5}=$\$$1\frac{1}{2}$.

2. What will three bushels of peas cost, if $1\frac{1}{6}$ bushels cost \$$5\frac{5}{6}$?

3. When $2\frac{1}{2}$ bushels of wheat cost \$$6\frac{1}{4}$, what will $\frac{4}{5}$ bushels cost?

4. If $5\frac{1}{2}$ yds. of silk cost \$$7\frac{2}{3}$, what will $2\frac{3}{4}$ yds. cost?

5. If $\frac{3}{8}$ of an orange cost $\frac{2}{3}$ of a cent, what will 12 oranges cost?

6. If 2 yds. of satin cost \$$4\frac{2}{5}$, what will $5\frac{1}{3}$ yds. cost?

7. If a man can cut 8 cords of wood in $\frac{4}{5}$ of a week, how much can he cut in $2\frac{1}{2}$ weeks?

8. If a man can walk 7 miles in 2 hours, how far can he walk in 3 days, by walking 10 hours a day?

9. If $3\frac{1}{4}$ barrels of apples cost $\$5\frac{1}{5}$, what will $\frac{1}{2}$ barrel cost?

10. A carpenter worked $11\frac{2}{3}$ days, and after paying his board and other expenses with $\frac{3}{7}$ of his earnings, had \$20 left: how much did he receive a day.

11. If 3 men incur an expense of $\$27\frac{3}{8}$, how much more than $\$7\frac{1}{2}$ must each pay.

12. If 3 pair of socks cost $\$\frac{9}{10}$, how many pairs can be bought for $\$2\frac{7}{10}$?

13. If 8 men can build a wall in $5\frac{3}{4}$ days, in how many days could 5 men do it?

14. If 9 men can perform a piece of work in $9\frac{1}{3}$ days, how long will 7 men take to do it?

15. A is three score years and ten; if $\frac{1}{5}$ of B's age is $\frac{1}{7}$ of C's and $\frac{1}{6}$ of C's is $\frac{1}{10}$ of A's how old is B?

16. If to $\frac{3}{5}$ of the number of sheep in a flock you add 70, you will double their number, how many sheep are there in the flock?

17. James is 18 years old, and $\frac{7}{9}$ of his age is $\frac{2}{3}$ of half his brother's age: how old is his brother?

18. If from a certain number increased by 7 you subtract 3, and multiply the remainder by $\frac{1}{4}$ of 20, the product is 80: what is the number?

19. If a pole 6 feet long casts a shadow of $6\frac{3}{4}$ feet, what will be the length of the shadow a pole of 9 feet will cast?

20. If 5 gold pens cost $\$7\frac{1}{2}$, what will 7 gold pens cost?

21. What is the length of a pole, the shadow of which is 10 feet long, at the same time a pole $5\frac{1}{2}$ feet long casts a shadow of 11 feet?

22. If a man earns \$$10\frac{1}{2}$ in 4 days, how many dollars will he earn in 14 days?

23. If $\frac{4}{3}$ of 9 be 6, what will a fifth of twenty be?

24. If $\frac{1}{3}$ of 10 be 3, what will $\frac{1}{9}$ of 20 be?

25. If 8 yards of ribbon cost \$$1\frac{7}{9}$, how many yards can be bought for \$$3\frac{1}{2}$?

26. If 2 apples are worth 1 orange, 2 pears are worth 3 apples, how many pears are worth 6 oranges?

27. If $\frac{3}{4}$ be 9, what will 7 be?

28. How many yards of cloth $\frac{4}{5}$ of a yard wide are equal to 12 yards $\frac{3}{4}$ of a yard wide?

29. If \$40 exceed by \$10 $\frac{1}{2}$ of $\frac{3}{4}$ of what I gained by the sale of a house and lot, how much did I gain?

30. If $\frac{1}{2}$ of a yard of cloth cost \$$\frac{3}{5}$, what will $\frac{7}{8}$ of a yard cost?

31 A man being asked his age, said that were he 3 times as old, $\frac{1}{12}$ of his age would be 8 years: how old was he?

32. If $\frac{3}{4}$ of A's age is $\frac{2}{3}$ of B's, and $\frac{3}{4}$ of B's age is $\frac{2}{3}$ of C's, how old are A and B, if C is 81 years old?

EXAMPLES.—28.

1. 7 is $\frac{2}{3}$ of what number?

Sol.—$\frac{2}{3}$ of some number is 7, 1 third is $\frac{7}{2}$, and 3 thirds, or the whole is 3 times $\frac{7}{2}$, or $\frac{21}{2}=10\frac{1}{2}$.

2. 6 is $\frac{3}{4}$ of what number?

3. 25 is $\frac{5}{9}$ of what number?

4. 14 is $\frac{7}{8}$ of what number?

5. 9 is $\frac{4}{5}$ of what number?

6. $\frac{2}{5}$ of 20 is $\frac{7}{8}$ of what number?

7. 13 is $\frac{3}{2}$ of what number?

8. $15\frac{3}{4}$ is $\frac{9}{7}$ of what number?

9. $\frac{7}{8}$ is $\frac{2}{3}$ of what number?

10. $\frac{5}{8}$ is $\frac{5}{12}$ of what number?

11. $\frac{3}{4}$ of $\frac{2}{5}$ is $\frac{5}{9}$ of what number?

12: James gave 9 cents for a slate which was $\frac{3}{4}$ of his money: how much had he?

13. A man bought a horse for $90 which was $\frac{6}{7}$ of his money: how much had he?

14. A gentleman was married at 30 years of age which was $\frac{1}{2}$ of $\frac{20}{9}$ of his wife's age: how old was the wife?

15. Two men agreed to build a wall, one man built 15 rods, which was $\frac{5}{6}$ of what the other built: how many did the second build, and what was the length of the wall?

16. A man sold $3\frac{1}{2}$ cords of wood at $\$3\frac{1}{2}$ a cord, which was $\frac{7}{8}$ of what he received for a ton of hay: how much did he receive for the hay?

17. Paid $\$\frac{7}{8}$ for a neck tie, which was $\frac{2}{7}$ of what my vest cost: what was the cost of the vest?

18. A son's age is 20 years, and it is $\frac{5}{12}$ of the father's age: what is the age of the father?

19. 15 is $\frac{5}{8}$ of how many times 7?

Sol.—$\frac{5}{8}$ of some number is 15, 1-eighth is 3, and 8-eighths is 8 times 3 or 24, 24 is $3\frac{3}{7}$ times 7.

20. 49 is $\frac{7}{9}$ of how many times 8?

21. 36 is $\frac{4}{7}$ of how many times 6?

22. 35 is $\frac{5}{6}$ of how many times 5?

23. 28 is $\frac{7}{3}$ of how many times 5?

24. $\frac{4}{5}$ is $\frac{6}{7}$ of how many times 3?

25. $\frac{9}{10}$ is $\frac{8}{9}$ of how many times $\frac{2}{3}$?

26. $1\frac{1}{8}$ is $\frac{5}{12}$ of how many times $2\frac{1}{3}$?

27. $\frac{5}{7}$ of 21 is $\frac{3}{5}$ of what number?

Sol.—$\frac{5}{7}$ of 21 is 15, 15 is $\frac{3}{5}$ of 25 $\therefore$ $\frac{5}{7}$ of 21 is $\frac{3}{5}$ of 25.

28. $\frac{7}{9}$ of 27 is $\frac{4}{7}$ of what number?

29. $\frac{3}{8}$ of 64 is $\frac{7}{9}$ of what number?

30. $\frac{16}{25}$ is $\frac{4}{9}$ of how many times $1\frac{1}{5}$?

31. $\frac{5}{9}$ of 36 is $\frac{4}{5}$ of how many times 5?

32. $\frac{4}{7}$ of 56 is $\frac{8}{9}$ of how many times 7?

33. $\frac{5}{8}$ of 48 is $\frac{5}{9}$ of how many times 9?

34. $\frac{5}{10}$ of 72 is $\frac{4}{9}$ of how many times 6?

35. $\frac{3}{7}$ of 56 is $\frac{8}{9}$ of 3 times what number?

Sol.—$\frac{3}{7}$ of 56 is 24, 24 is $\frac{8}{9}$ of 27, which is 3 times 9: therefore 9 is the required number.

36. $\frac{5}{6}$ of 54 is $\frac{5}{8}$ of 9 times what number?

37. $\frac{2}{9}$ of 81 is $\frac{3}{11}$ of 4 times what number?

38. $\frac{4}{3}$ of 36 is $\frac{6}{5}$ of 10 times what number?

39. $\frac{7}{9}$ of 108 is $\frac{7}{12}$ of 8 times what number?

40. $\frac{4}{7}$ of $\frac{5}{6}$ is $\frac{2}{3}$ of 6 times what number?

EXAMPLES.—29.

1. A horse cost \$80, and $\frac{4}{5}$ of the cost of the horse is $\frac{1}{8}$ of four times the cost of the carriage: what was the cost of the carriage?

2. A watch cost \$60; and $\frac{4}{5}$ of the cost of the watch is $\frac{2}{7}$ of 6 times the cost of the chain: the price of the chain is required.

3. A cow cost \$40, and $\frac{2}{3}$ of this is $\frac{2}{7}$ of 8 times the cost of a sheep: what is the cost of a sheep?

4. A house is worth \$12,000, and $\frac{4}{5}$ of its value is $\frac{3}{8}$ of 100 times the value of the lot: what is the value of the lot?

5. What number added to 4 times $\frac{3}{5}$ of 21 will make 52?

6. The insurance of a house amounted to \$80, and $\frac{1}{4}$ of that is $\frac{1}{30}$ of 3 times its value: what is the value of the house?

7. A horse cost \$180, and $\frac{2}{3}$ of the cost of the horse is $\frac{2}{9}$ of 6 times the cost of a cow: what was the cost of a cow?

8. The distance from Montreal to Prescott is 112 miles, $\frac{4}{7}$ of this distance is $\frac{1}{43}$ of 16 times the distance to Kingston: what is the distance from Montreal to Kingston, and from Kingston to Prescott?

9. Kingston is 48 miles east of Belleville, and $\frac{1}{8}$ of 11 times this distance is $\frac{5}{8}$ of $\frac{2}{5}$ times the distance between Montreal and Cobourg: what is the distance from Montreal to Cobourg?

10. Port Hope is 33 miles from Whitby, which is $\frac{1}{2}$ the distance between Napanee and Cobourg, and $\frac{7}{11}$ of this distance is $\frac{3}{4}$ of $\frac{1}{4}$ of the distance from Montreal to Ottawa, and of 60 miles more: what is the distance from Montreal to Ottawa?

11. A yard of a certain kind of cloth, 4 quarters wide, is worth \$4: what will a yard and a-half of the same kind of cloth, 5 quarters wide, be worth?

12. $\frac{2}{3}$ of $\frac{1}{2}$ of 60, is $\frac{4}{9}$ of how many times $\frac{3}{4}$ of $\frac{5}{6}$ of 24?

13. A man had $\frac{5}{6}$ of his money stolen from him; the thief was not caught until he had spent $\frac{2}{3}$ of it, the remainder, 50 dollars, was given back: how much money had he at first?

14. A farmer dividing his farm between his two sons gave the elder 10 acres more than $\frac{2}{5}$ of the whole, and the younger the remainder, which was 22 acres more than $\frac{1}{3}$ of the whole: how many acres in the farm?

15. Bought a piano for \$240, and $\frac{2}{5}$ of the cost was $\frac{4}{3}$ of what I received of 8 young ladies for the use of it one year: how much did each young lady pay?

16. A shoemaker's tools are worth \$80; $\frac{3}{4}$ of this is

$\frac{2}{3}$ of $\frac{1}{2}$ of 2 times the value of the stock: what is the value of the stock?

17. A farmer, after selling \$200 worth of his stock, finds that $\frac{5}{7}$ of the remainder is equal to $\frac{5}{6}$ of three times the amount sold: what was the value of his stock at first?

18. Two boys comparing their money—one said he had 60 cents, the other said, $\frac{7}{10}$ of your money is just $\frac{5}{12}$ of 6 times my money: how many cents had the latter?

19. A boy being asked his age, said that 18 years was 2 years less than $\frac{3}{4}$ times $\frac{5}{3}$ of his age: how old was he?

20. A man pays \$600, and $\frac{3}{4}$ of this is just $\frac{2}{3}$ of $\frac{1}{2}$ of twice his annual income: what is his annual income?

21. A gentleman is 64 years old, which is $2\frac{2}{3}$ times the age of his eldest son, and the eldest son is $2\frac{2}{5}$ times as old as his youngest brother: what is the difference in the ages of the two brothers?

22. A and B engaged in play; A had $\frac{2}{3}$ as much money as B, B gaining \$16, which was $\frac{2}{9}$ of $1\frac{1}{2}$ times as much as he commenced with: how much did he commence with, and how much had he left?

23. A farmer gave $\frac{2}{3}$ of $1\frac{1}{5}$ times his ready money for a buggy, $\frac{3}{4}$ of what was left for a harness, and had remaining \$12: what did he pay for the buggy?

24. A does a piece of work in 4 days, and B in 5 days: in what time could both together do the work?

Ans.—A in 1 day does $\frac{1}{4}$, and B $\frac{1}{5}$ $\therefore$ both do $\frac{9}{20}$ in 1 day, $\frac{1}{20}$ in $\frac{1}{9}$ day $\therefore$ the whole in $\frac{20}{9}=2\frac{2}{9}$ days.

25. One tap fills a cistern in 3 hours, another in 5 hours: in what time would both running together fill it?

26. A does $\frac{2}{5}$ of a work in 4 days, when B comes to help him, and they finish it in $\frac{5}{3}$ days: how long would each by himself take to do the work?

27. If A can do a piece of work in 6 days, and B $\frac{1}{3}$ as much again as A in a day, how long would B take to complete the work after A had worked $1\frac{1}{2}$ days?

28. A can do a piece of work in 6 hours, and B in 8 hours: how long would B take to finish the work after A had worked 3 hours?

29. A does $\frac{4}{9}$ of a piece of work in 16 days, he then calls in B, and they do the work in 4 days more: how long would B take to do the work?

30. A does a piece of work in 3 hours, which is twice the time B and C together take to do it, and A and C could do the work in $1\frac{1}{2}$ hours: how long would B alone take to do it?

31. A, B and C can dig a ditch in 20 days, A and B in 40 days, and A and C in 30 days: how long would each take to do it?

32. One shoemaker makes a pair of boots in $\frac{2}{3}$ of a day, another in $\frac{2}{5}$ of a day: how many pair can both make in a day?

33. A, B and C can do a piece of work in 5 days, B and C can do it in 8 days: in what time can A do it alone?

34. A and B can do a piece of work in 30 days, B in 70 days: how much more of the work does A do than B?

35. If 5 men can do a work in 10 days, how many men could do 4 times as much in one-fifth of the time?

36. If a barrel of flour supply 4 persons 5 weeks, how much will supply 3 persons $2\frac{1}{2}$ weeks?

37. If 3 furnaces consume $12\frac{1}{4}$ tons of coal in 25 days, how long will $8\frac{3}{4}$ tons last 5 furnaces?

38. A and B can do a piece of work in $1\frac{5}{7}$ days, A and

C in $1\frac{7}{8}$ days, and B and C in $2\frac{2}{9}$ days: in what time could B alone do it?

39. A can do a piece of work in 3 days, B in 4, and C in 6. A leaves off $\frac{1}{2}$ a day before the work is finished, and B $\frac{2}{3}$ of a day, C finishes the work: how many days did A, B and C work?

40. A crew can row down a stream a certain distance in 30 minutes and back again in 32, what fraction of the distance is the rate of the stream an hour? If the rate of the stream be half a mile an hour, what will the distance be?

41. A crew rowed down stream **7** miles in 30 minutes and up stream the same distance in 35 minutes: find the rate of the stream per hour.

42. A crew can row down a stream in 20 minutes and back again in 30: find the distance, the rate of the stream being $1\frac{1}{2}$ miles an hour.

CHAPTER III.

REDUCTION AND COMPOUND RULES.

Section I.—Currency.

EXAMPLES.—30.

1. How many farthings in 1 half penny? in 2 pence? in 3 pence? in 6 pence? in $5\frac{1}{2}$ pence? in $7\frac{3}{4}$ pence?

2. How many pence in 5 cents? in 10? in 20? in 25?

3. How many 5 cent pieces make a dollar? how many 10? how many 20?

4. How many cents in 3 pence? in 6d? in 9 pence? in 12 pence? in 30 pence? in 60? in 15 pence?

5. How many farthings in 8 pence? in 12d? in 60d? in 7½d? in 9¾d?

6. How many shillings in $1? in $2? in $4? in $10? in one-fifth of a dollar? in 3-fifths? in 4-fifths?

7. How many sixpences in 1 shilling? in 2 shillings? in 3 shillings? in 4s. 6d? in 7s. 9d? in 3s. 11d?

8. How many 5 cent pieces are equal in value to 60 pence? 12 pence? 10 shillings? 7s. 6d?

9. How many dollars in 1 pound? in £2? in £5? in £1 12s? in £2 13s?

English Money.

EXAMPLES.—31.

1. How many farthings in 1 penny? in 2 pence? in 6 pence? in 20 pence? in 12 pence? in 5½d! in 6½d? in 7¾d? in 10¾d?

2. How many pence in 4 farthings? in 12 farthings? in 36 farthings? in 48 farthings? in 63? in 50? in 47?

3. How many pence in 1 shilling? in 4 shillings? in 7 shillings? in 10 shillings? in 20 shillings? in 4s. 6d? in 7s. 9d? in 8s. 11d?

4. How many shillings in 12 pence? in 48 pence? in 36 pence? in 60 pence? in 240? in 50d? in 69d?

5. How many shillings in 1 pound? in £4? in £7? in £10? in £1 10s? in £1 6s? in £3 15s? in £2 19s?

6. How many pounds in 20 shillings? in 40s? in 80s? in 120s? in 30s? in 49s? in 67s? in 75s?

7. How many pence in 4s. 6d? in 5s. 6d? in 10s. 3d? in 12s. 6d? in £1 13s. 6d?

8. How many shillings in £2 6s? in £3 9s? in £6 10s?

9. At 3½d a pound, how many shillings will 24 pounds of rice cost?

10. At 5 shillings and 6 pence a yard, how many pounds will 16 yards of carpeting cost?

11. How many crowns in £1? in £5? in £10 5s? n £11 10s?

12. In reducing £3 10 shillings to shillings, which is the multiplier, the 3 or the 20? Give reasons for your answer.

UNITED STATES MONEY.

EXAMPLES.—32.

1. How many mills are there in 8 cents? in 12 cts? in 15 cts.?

2. How many cents are there in 60 mills? in 80 mills? in 40 mills? in 45 mills? in 57 mills?

3. How many cents in one dime? in 3 dimes? in 7 dimes? in 14 dimes?

4. How many dimes in 10 cents? in 20 cents? in 43 cents? in 90 cents? in 85 cents?

5. How many dimes in $1? in $3? in $7? in $8? in 2-fifths of a dollar? in 3-fifths? in 4-fifths?

6. How many dollars in 1 eagle? in 2 eagles? in 7 eagles? in 11 eagles?

7. How many eagles in 10 dollars? in 20 dollars? in 70 dollars? in 120 dollars?

8. How many dollars in 100 cents? in 200 cents? in 700 cents? in 125 cents? in 235? in 510?

9. Bought 20 yards of cloth at one-half dollar a yard: how many dollars did I pay?

10. How many yards of cloth at 6 dimes a yard can you buy for 2 eagles?

11. How many cents in one-half dollar? in one-fifth of a dollar? in 3-fifths? in 7-tenths? in 9-tenths?

Section II.

MEASURES OF WEIGHT—TROY WEIGHT.

EXAMPLES.—33.

1. How many grains in one penny-weight? in 2 penny-weights? in 4 penny-weights? in 3 dwt. 9 gr.? in 2 dwt. 8 gr.?

2. How many penny-weights in 24 grains? in 48 grains? in 96 grains? in 60 grains? in 75 grains?

3. How many penny-weights in 1 ounce? in 2 ounces? in 5 ounces? in 2 oz. 10 dwt.? in 3 oz. 15 dwt.? in 7 oz. 13 dwt.?

4. How many ounces in 20 penny-weights? in 40 penny-weights? in 100 penny-weights?

5. How many ounces in 1 pound? in 2 lb.? in 5 lb.? in 9 lb.? in 12 lb.? in 3 lb. 8 oz.? in 4 lb. 9 oz?

6. How many pounds in 12 ounces? in 36 ounces? in 60 ounces? in 144 ounces? in 65 oz.? in 90 oz.?

7. How many penny-weights in 2 oz. 10 dwt?

8. In 5 lb. 7 oz., how many ounces?

9. Find the value of 4 oz. of gold, if 3 dwt. are worth 18 shillings?

10. In 1 pound how many grains?

11. How many spoons, weighing 35 dwt. each, can be made out of 1 lb. 2 oz. of silver?

12. A jeweller bought 7 dwt. of pure gold, 9 dwt. of gold coin, and 16 dwt. of silver : how many ounces did he buy altogether?

13. If 10 dwt. of silver are worth 70 cents, find the value of 3 pounds of silver.

Reduction.—Apothecaries' Weight.

Examples.—34.

1. How many scruples in 5 oz? in 1 lb.?

2. In 95 gr. how many drams? in 4 lb. 5 oz., how many drams?

3. How many grains in 3 dr. 5 sc.?

4. How many grains in 1 oz.? in 2 ounces? in 5 ounces?

5. How many drams will it take for 20 powders, each containing 20 grains?

6. How many powders of 1½ sc. each can be put up from an ounce of soda?

7. If a druggist charges 50 cents for ten powders containing 15 gr. each, at what rate is that per ounce?

8. A druggist charges 8 cents for 4 drams of opium : what rate is that per pound?

9. How many scruples, drams and ounces, and of each an equal number, are there in 7 pounds?

10. Two-thirds of 18 scruples of a certain drug cost 36 cents : what will 4-sevenths of 14 pounds cost?

Examples.—35.

1. How many drams in 4 oz.? in 8 oz.? in 10 oz.? in 5 oz, 10 dr.? in 7 oz. 12 dr.?

2. How many ounces in 2 pounds? in 5 pounds? in

32 drams? in 3 lb. 5 oz.? in 4 lb. 9 oz.? in 2 lb. 11 oz.?

3. How many pounds in 2 quarters? in 3 quarters? In 4 quarters? in 48 ounces? in 96 ounces? in 2 qr. 12 lb.? in 3 qr. 15 lb.?

4. How many hundred-weight in 4 quarters? in 8 quarters? in 16 quarters? in 20 quarters?

5. How many hundred-weight in 2 tons? in 3 tons? In 2,000 lb.? in 4,000 lb.? in 2 tons 3 cwt.

6. How many lbs. in 1 cwt. 2 qr. 13 lb.?

7. How much will 2 cwt. 1 qr. of beef cost at 10 cents a pound?

8. How many four-ounce weights can be made out of 2¼ pounds of brass?

9. How many 7 lb. packages of sugar can a grocer put up from 2 cwt? from 2 qr. 13 lb.?

10. Bought 1 cwt. of meat for $17.50; sold it at 22 cents a pound: what was the whole selling price? What was the profit?

11. I gave 3 cwt. 2 qr. of hay worth $20 a ton, for butter worth 25 cents a pound: how much butter did I get?

Section III.—Measures of Length, Surface, and Volume.

Examples.—36.

LONG MEASURE.

1. How many inches in 1 foot? in 2 ft.? in 5 ft.? in 2 ft. 6 in.? in 5 ft. 11 in.? in 8 ft. 4 in?

2. If 4 inches make a hand, what is the height in feet of a horse 15 hands high?

3. How many feet in a yard? How many in a fathom? in 2 yds. 2 ft.? in 12 yds. 1 ft.?

4. How many times will a stick 5 yards long be contained in a mile?

5. How many yards in 4 furlongs? in 7 fur.? in 5280 feet? in 272 feet?

6. How many chains in a mile? in 160 rods? in 6 furlongs? in 136 in., how many yards?

7. How many inches in 3 yds. 2 ft. 10 inches?

8. What will it cost to dig a ditch a quarter of a mile long, at 50 cents a rod?

9. The roads in Ontario are 1 chain wide, what is the width in rods?

10. If it takes 5 minutes to travel a furlong, how long will it take to travel a mile?

11. A man travels 50 rods in 5 minutes, how long will it take him to travel one mile?

12. How many steps, each 2 feet long, will a boy take in walking 110 yards?

Cloth Measure.

EXAMPLES.—37.

1. How many nails in 2 quarters? in 5 qrs.? in 18 inches? in 24 inches?

2. How many quarters in 4 yards? in 3 yards? in 12 yards? in 5 yds. 2 qrs.? in 6 yds. 3 qrs.?

3. What cost 10 yards of velvet, at $10 an ell, English?

4. What will 18 yards of cloth cost, at $12 a French ell?

5. How many dresses each containing 12 Flemish ells can be made from a piece of cloth containing 18 French ells?

6. How many nails in three yds. 3 qrs. 3 nails? in 75 nails, how many yds. &c.?

7. How many dresses each containing 10 yds. can be made from a piece of cloth containing 40 ells, English?

8. A coat requires 3 yds. of cloth: how many coats can be cut from 40 Flemish ells?

9. In 7 yds. 2 qrs., how many E. E.? how many E. Fr.? how many E. Fl.?

10. If 5 yards of cloth cost 7 dollars, how many yards can be bought for 56 dollars?

Square Measure

EXAMPLES.—38.

1. A black-board is 4 feet wide and 12 feet long: how many square feet of furface has the board?

2. A slate has a surface of 80 sq. in., it is 8 in. wide: find its length.

3. How many sq in. in one-sixth of a sq. ft.? in 3-sixths? in 5-sixths?

4. How many square inches in a board 4 inches long and one inch wide? in 4 inches long and 2 in. wide? in 4 inches long and 3 inches wide?

5. A board is 3 yds. long and one yard wide: how many square yards in it?

6. How many square feet in 3 square yards? in 8 square yards?

7. A yard of carpet is 3 ft. long and 3 ft. wide: how many square feet in it?

8. How many square feet in a yard of cloth 2 feet wide? in 5 ft. wide?

9. How many square feet in a room 12 ft. by 15 ft.? how many sq. rods in 1 ac. 20 rd. of land?

10. How many yards of carpet 2 ft. wide will be required to cover the floor of the above room?

Cubic Measure.

EXAMPLES.—39.

1. How many cubic feet in one-ninth of a cubic yard? in 4-ninths? in 7-ninths?

2. How many cubic feet in 3 cubic yards? 9 cubic feet?

3. A brick is 2 by 4 by 8 inches: find its solidity?

4. How many cubic feet in 1 cubic yard? in 3 cubic yards? in 4 cubic yards?

5. How many cubic yards in 27 cubic feet? in 81 cubic feet? in 100 cubic feet?

6. How many cubic feet in 2 tons of timber? in 5 tons?

7. How many cords in 32 cord feet? in 24 cord feet? in 80 cord feet?

8. How many cords in a pile of wood 24 feet long, 4 feet wide, and 4 feet high?

9. How many loads of earth, each 1 cubic yard, must be removed in digging a cellar 21 feet long, 18 feet wide, and 6 feet deep?

10. How many cubic feet are in a stick of timber 16 inches wide, 9 inches thick, and 21 feet long?

Liquid Measure.

EXAMPLES.—40.

1. How many gills in 4 pints? in 8 pints? in 12 pints? in 11 pints, 2 gills? in 13 pints 3 gills?

2. How many pints in 16 gills? in 32 gills? in 36 gills? in 47 gills?

3. How many quarts in 3 gallons? in 8 gallons? in 15 gallons? in 10 gallons 3 quarts? in 13 gallons 2 quarts?

4. How many gallons in a pipe? in 1 hogshead? in 1 tun? in 4 barrels? in 6 barrels?

5. If a tumbler hold half a pint, how many times will 1 gallon of water fill it?

6 Bought 5 gallons of oil for $10, what is the price per quart?

7. Bought a pint of milk for 4 cents, at what rate is that per gallon?

8. 3 pints of molasses having been sold out of 2 gallons, what is the remainder worth at 80 cents a gallon?

9. A merchant bought a hogshead of molasses for $40 and sold it at the rate of 30 cents for 6 pints, how much did he gain by the bargain?

10. How many pint bottles will be required to hold 4 gal. 2 qts. of tomato catsup?

Dry Measure.

EXAMPLES.—41.

1. How many pints in 2 quarts? in 5 quarts? in 7 quarts? In 8 qts. 1 pt.? in 9 qts. 1 pt.?

2. How many quarts in 1 peck? in 2 pecks? in 5 pecks? in 4 pks. 3 qts.? in 5 pks. 2 qts.?

3. How many pints in 1 peck? in 3 pecks? in 7 pecks? in 2 pks. 1 gal. 2 qts.?

4. How many pints in 3 bushels, 3 pks. 3 qts.?

5. If a chaldron of coal costs \$12, what is the price per bushel?

6. How many baskets, holding 2½ pecks each, will 5 bushels of apples fill?

7. If a horse is fed 6 quarts of oats a day, how long will it take him to consume 6 bushels?

8. If 8 pints of strawberries cost 32 cents, what will 1 bushel cost at the same rate?

9. A sold to B 1 bushel and 1 peck of currants, at 2 cents a pint, and received in payment 1 bushel of raspberries at 4 cents a pint: who pays the difference, and how much?

10. A farmer sold 2 bushels 3 pecks of clover seed at \$6 a bushel, receiving in payment 5 bushels 2 pecks of wheat at \$1.50: what is yet due him?

11. A boy gathered 3 bushels 4 quarts of chestnuts: how many times would they fill a pint measure?

TIME TABLE.

EXAMPLES.—42.

1. How many seconds in 2 minutes? in 4 minutes?

2. How many minutes in 2 hours? in 4 hours? in 120 seconds?

3. How many hours in 2 days? in 4 days? in 360 minutes? in 3,600 seconds?

4. How many days from 1st January to the 17th of March? from 3rd February to 1st July?

5. How many months from August 9th to November

9th? from June 2nd to November 2nd? from April 6th to October 6th?

6. Which years are leap years? Which of the months have 31 days? How many days has 5th month? the 11th month?

7. What are the natural divisions of time? how are the year and day divided?

8. If a man can do a piece of work in 30 minutes, how many hours would it take him to do 15 times as much?

9. A can do a piece of work in 20 minutes: how many hours would it take him to do 24 times as much?

10. How many months and days from the 2nd of January to the 10th September?

11. If a man earns 125 cents in 6 hours, how much will he earn in 12 days of 10 hours each?

12. If a man earns $12 a week, and pays for expenses $12 per month of four weeks, how much will he save in 40 weeks?

13. A man walks one-fourth of a mile in 5 minutes, how long will it take him to walk 10 miles?

14. If 12 men can do a work in 1 hour 45 minutes, how long would it take 1 man? 2 men? 5 men?

MISCELLANEOUS TABLE.

EXAMPLES.—43.

1. How many units in a dozen? in 4 dozen?

2. What is the cost of 4 dozen of peaches at 2 cents a piece?

3. What cost 1 gross of writing books at 10 cts. each?

4. How many score in 60? in 80? in 100?

5. What cost a ream of paper at 10 cents a quire? 1 gross of pens at 5 cents a dozen?

6. At $11 a hundred-weight, what costs 1 barrel of beef? 3 barrels of beef?

7. Bought a barrel of pork at 12 cents a pound, and sold it at $15 a cwt.: how much was made by the sale?

8. Bought wheat at 3 cents a pound, and sold it at $2 a bushel: how much was made on a bushel?

9. Paid 5 cents a pound for flour: how much was that a barrel?

10. Bought 170 lbs. of oats: what was the cost at 62 cents a bushel?

11. Bought 300 lbs. of wheat at 2 cents a pound, and sold it at $1.50 a bushel: how much did I gain?

Compound Rules.

EXAMPLES.—44.

1. Add 7 bushels 2 pks. and 8 bushels 3 pks?

2. A grocer sold on Monday 5 gals. 2 qts. of molasses; on Tuesday, 2 gals. 2 qts., and on Wednesday 4 gals. 3 qts.: how much did he sell in the three days?

3. How many acres are there in two fields, one containing 9 acs. 70 rds., the other 8 acs. 90 rds.?

4. A fore quarter of lamb weighed 7 lbs. 9 oz., and a hind quarter 8 lbs. 12 oz.: how much did both quarters weigh?

5. Find the sum of 3 yds. 2 ft. 9 in., and 4 yds. 2 ft. 6 inches.

6. A farmer sowed 1 bushel 4 qts. of clover-seed, and 1 bushel 2 pks. 3 qts. of timothy-seed: how much did he sow of both kinds?

7. Add together 50 cubic yds. 13 cubic ft. and 10 cubic yds. 17 cubic ft.?

8. A coal dealer delivered 12 tons 10 cwt. of coal to one man, and 8 tons 15 cwt. to another: find the whole quantity sold to these two men.

9. A man had 9 bushels 3 pks. of potatoes, he sold 5 bushels 2 pks.: what quantity had he left?

10. A grocer had 13 lbs. 8 oz. of castile soap, he sold 8 lbs. 10 oz.: how much had he left?

11. From 16 ft. 5 in. take 11 feet 7 inches?

12. From a cask containing 16 gals. 2 qts. of vinegar, 10 gals. 3 qts. were drawn: how much was left?

13. I have 9 weeks vacation and 6 weeks 4 days have already passed: how much of it is left?

14. A crock with the butter in it weighs 34 lbs. 8 oz., the crock alone weighs 7 lbs. 12 oz.: how much butter does it hold?

15. From a piece of land containing 7 acres, 3 acres 70 sq. rods were sold: how much is left?

16. It takes one hour 45 minutes to go by rail from Toronto to Hamilton, and 3 hours and 20 minutes to go by boat: how much time do I save by rail?

EXAMPLES.—45.

1. How much tea will it take to fill 6 canisters, each containing 1 lb. 8 oz.

2. If a horse eats 2 pks. 6 qts. of oats in 2 days, how much will last him 14 days?

3. Multiply 3 qts. 1 pk. by 10.

4. It takes 7 yds. 3 qrs. of cloth to make one suit of clothes: how much will be required for 5 suits?

5. If 3 cows eat 3 tons 18 cwt. of hay during the winter, how much would keep 6 cows?

6. If it requires 2 bushels 1 pk. 2 qts. of wheat to sow an acre of land, how much will be required for 5 acres?

7. Jennie is 9 years 7 months old, and her mother is 4 times as old : find her mother's age?

8. If a family use 8 dozen 9 eggs in 2 weeks, how many dozen would they use in 8 weeks?

9. Find the weight of 6 cubic feet of granite, when 1 foot weights 1 cwt. 1 qr. 15 lbs.?

10. Multiply 2 gals. 1 qt. 1 pt. by 7.

11. If 11 bushels 3 pks. of grain sow 5 acres, how much is required for 1 acre?

12. Divide 21 miles 40 rds. by 4.

13. If a cooper can make 4 barrels in 5 hours, how long will it take him to make 3 barrels?

14. Four bags weigh together 8 cwts. 2 qrs. 10 lbs : what is the average weight of each bag?

15. Divide 35 years 6 months by 6.

16. If one barrel holds 2 bushels 3 pks. of apples, how many barrels will be required to hold 5 bushels 2 pecks?

17. I divided 12*s*. 6*d*. among a number of boys, giving each 2*s*. 6*d*. how many boys were there?

18. A stationer sold 21 gross 7 dozen of copy books in 6 days : find the average daily sales.

19. A farmer cut 15 tons 5 cwt of hay from 5 acres : what was the average per acre?

EXAMPLES.—46.

1. What is the sum of 15s. 9d. and 3s. 6d.

2. What is the sum of £1 3s. 9d. and £5 9s. 4d.?

3. A boy throws 3 pks. 6 qts. of potatoes into a barrel already containing 2 pks. 3 qts., how many bushels, &c., are then in the barrel?

4. A grocer mixes three kinds of tea; 5 lbs. 11 oz. of the first kind, 6 lbs. 7 oz. of the second, and 3 lbs. 10 oz. of the third: how many pounds in the mixture?

5. From a bin containing 10 bush. 3 pks. 1 qt. of oats, a person took 3 bush. 2 pks. 6 qts., how much was left?

6. How much of my fence remains to be built, if there is 15 rods 5 yds. to be built in all, and 11 rods 2 yds. 1 ft. is completed?

7. What are the contents of 8 pitchers, if each hold 1 qt. 1 pt. 1 gill?

8. If 1 man can do a piece of work in 4 hours 45 min., how long will it take 6 such men to do it?

9. How many quart boxes will 2 pks. 6 qts. of berries fill?

10. How much must I pay for a piece of land 10 rods by 12, at the rate of $160 an acre?

11. A school walk containing 240 sq. ft. is 12 ft. wide, what is the length?

12. How long must a box be that is 4 ft. wide and 3 ft. deep to contain 1 8 cubic feet?

13. What will 3 gross and 6 buttons cost at 10 cents a dozen?

14. At 40 cents a square foot, what will be the cost of a piece of land 30 ft. by 50 ft.?

15. A boy observes that the fore wheel of his little wagon makes 55 revolutions more than the hind wheel in going 20 rods: what is the circumference of the fore wheel, that of the hind one being 3 feet?

16. The difference between the product of two numbers and 9 is 171. One of the numbers is 12, what is the other?

17. A room 15 ft. long by 12 ft. wide costs $30 to carpet it: what would it cost to carpet a room with the same carpet if it were one yard less in length, and 2 feet less in width?

18. How many days of 6 hours each will it take 15 men to do a piece of work, if 5 men can do it in 9 days of 10 hours each?

19. How far will a locomotive, moving at the rate of 6 miles in 15 minutes, go in an hour and a half?

20. At 3 cents an inch, how much will 2 yards, 2 feet, 2 inches of silver wire cost?

21. How many bricks 9 inches by 4 will be required for the bottom of an oven 8 ft. by 6 ft.?

22. The divisor and quotient are the same, the remainder is 7 inches, which is two less than the divisor: what is the dividend?

23. A room 12 feet wide costs $30 to carpet it, but if it had been 3 feet less in length it would only have cost $24. Find the length of the room.

24. A owes B $25.20, and gives him on account $17.75. If he pays the balance with a ten-dollar bill, how much change should he receive?

25. Divide 20 bush. 7 pks. 3 qts. of potatoes into 10 equal heaps: how much have we in each heap?

26. At $2 a square rod, a man paid $960 for a building lot: how much land did the lot contain?

27. From a pile of wood containing 7 cords, a man sold 4 loads, each 12 feet long, 4 feet wide, and 4 feet high: find how much remained.

28. When peas are worth $1.60 a bushel, what will 6 quarts cost?

29. Find the cost of 12 lbs. 16 oz. of ham, at 16 cents a pound.

30. It costs $20 to carpet a bedroom with carpet costing $1 a square yard; the room is 12 feet wide: how long is it?

31. Find the cost of fencing, at $3 a rod, a field which is 60 rods long and 40 rods wide.

32. How much clover seed will be required to sow a field of 8 acres, one acre requiring 1 peck, 5 qts?

33. A stationer paid $3 a ream for paper, and sold it at 27 cents a quire: find his gain on 5 reams.

34. A market woman took 6 dozen of eggs to market, broke 9 of them, and sold the remainder at 28 cents a dozen: how much did she receive?

35. What is the value of a load of oats weighing 1037 lbs. at 40 cents a bushel?

36. Find the thickness of a block of stone containing 360 cubic feet, its length being 30 feet, and its width 4 feet.

37. A floor is 21 feet long and 6 yards wide: what will be the cost of painting it, at 30 cents a square yard?

38. What will be the cost of 17 cwt. 3 qrs. 10 lbs. of iron, at $60 per ton?

39. How many bushels of wheat are there in a load of 32 bags, each bag containing 92 pounds?

40. How many *pint* and *quart* bottles, of each an equal number, can be filled from 19 gals. 3 qts. 1 pt. of currant wine?

CHAPTER IV.

Questions for Examinations.

(1)

1. John had 26 marbles, he won 32, and then sold 40: how many had he left?

2. A drover bought 25 sheep at $5 a head, and 5 cows at $36 a head: find the cost of the whole.

3. A farmer sold 35 barrels of apples at $4 a barrel, and bought with the proceeds pork at $5 per cwt.: how much pork did he get?

4. If I bought 80 turkeys at the rate of 10 for $6, and sold them at the rate of 16 for $14, how much did I gain?

5. A boy bought a book for half a crown, a slate for 6d.: how much change did he get out of half a guinea?

6. How many lbs. of sugar at 4d. a pound, can be bought for a crown and a shilling piece?

7. The L. C. M. of two numbers is 24 and their G. C. M. 4; one of the numbers is 8: find the other?

8. I own $\frac{3}{4}$ of $\frac{4}{10}$ of a ship worth $30,000, and I sell $\frac{2}{3}$ of my share: what is the value of my remaining interest in the ship?

9. If the four-pound loaf is worth 10 cents when wheat is $1 a bushel, what should be charged for it when wheat is worth $1,10 per bushel?

10. Susie being asked her age, said: If the difference between $\frac{5}{12}$ of my age and $\frac{5}{9}$ of it is multiplied by 12, the product will be 20: find her age?

11. Multiply 16 by 12, add 8, divide by 400, multiply by 128, take the square root, and multiply by 50 : what is the result?

12. A can do a piece of work in 4 days, and B in $4\frac{1}{2}$ days : in what time will both working together do $\frac{2}{3}$ of the work?

13. $\frac{3}{4}$ of 56 is $\frac{7}{8}$ of how many times 16?

(2.)

1. I bought a horse for $175, kept him 7 weeks at a cost of $35, and sold him for $275 : how much profit had I?

2. The dividend is 285, the quotient 17, and the remainder 13 : find the divisor.

3. Bought 10 reams of paper at 20 cents a quire, and sold it for $4.50 : what was my gain on each quire?

4. I divided £1 7s. 6d. among a number of children, giving 1s. 3d. to each : how many were there?

5. Divide $75 between A and B, giving B $15 more than A.

6. $\frac{4}{11}$ of the candidates at an entrance examination failed in English grammar, $\frac{3}{14}$ of the remainder failed in arithmetic, and 15 passed : how many candidates were there?

7. The distance from Yarmouth to Boston is 240 miles, and twice the distance from Yarmouth to St. John is 30 miles less than $\frac{7}{8}$ of the distance from Yarmouth to Boston : find the distance from Yarmouth to St. John.

8. A man working $9\frac{3}{4}$ hours a day can do a piece of work in 8 days : how many days will it take him if he works only $6\frac{1}{2}$ hours a day?

9. A and B can do a work together in $2\frac{1}{4}$ days, A can do 3 times as much in a given time as B : find the time each would take to do it.

10. A boy spent $\frac{2}{5}$ of his money, and then found that \$10 was $\frac{5}{12}$ of what he had remaining: how much had he at first?

11. It costs \$72 to carpet a room 24 feet long and 18 feet wide: what would it cost if the room were a yard wider?

12. If to my age you add $\frac{3}{5}$ of it and 15 years, the sum will be 39 years: find my age.

(3.)

1. A farmer sold a horse for \$132, and a cow for \$68: how much had he left after paying \$85 for a waggon?

2. \$450 is divided between Harry and James; as often as the former gets \$8 the latter gets \$7: how much does each receive?

3. When \$400 is paid for 25 acres of land, what will 1 acre and 1 rood cost?

4. A market woman sold 4 lbs. 4 oz. of butter, at 32 cents a pound, and took her pay in cotton at 8½ cents a yard: how many yards did she have?

5. Find the least number from which 17, 34, and 51 can be subtracted an exact number of times.

6. A man after paying an income tax of 2½ cents in the dollar, had \$1,560 left: find his income for a year?

7. A can do $\frac{8}{15}$ of a piece of work in 9 hours, and B in 15 hours; after A has worked 3 hours B comes to work: in what time will the work be finished?

8. A boy being asked how much money he had, replied: if you add 1 to **5** times what I have, 13 times the square root of the sum will be 117: how much had he?

9. How many yards of carpet 27 inches wide will it take to carpet a floor 18ft. 9in. long and 12ft. wide?

10. A man failing in business was able to pay only $\frac{2}{5}$ of his debts; a certain creditor received $940: what was the amount of his creditor's full claim?

11. In a High School $\frac{3}{4}$ of the scholars study Latin, $\frac{2}{5}$ of the remainder study German, and the rest trigonometry, and there are 5 more in trigonometry than in German: find the number of scholars in the school?

12. A father and his son earned $75 in one month; the father earned $1\frac{1}{2}$ times what the son earned: find what each earned per month.

(4.)

1. A man bought a house-lot 10 rods square for $400, and sold it for $41 a square rod: how much did he gain or lose?

2. A boy bought a number of oranges for $2.75, and sold them for 7 cents each: how many did he buy?

3. The area of a room is $20\frac{2}{3}$ square yards; its length being 15ft. 6in.: find its breadth.

4. A man invests $\frac{1}{3}$ of his fortune in land, $\frac{1}{6}$ in bank stock, $\frac{1}{2}$ in business, and has $3,375 left: find the amount of his fortune.

5. What number must be added to 355 to get a sum exactly divisible by 17?

6. $\frac{5}{8}$ of my present age is $\frac{5}{6}$ of my age 10 years ago: find my present age.

7. Bought 12 yards of tweed at $2.75 a yard, 16 yds. of silk at $2.12 a yard, and 50 yards of cotton at $14\frac{1}{2}$ cents a yard: find the amount of the bill.

8. Of all the numbers (besides unity) which may be subtracted an exact number of times from 255, which be taken the *greatest* and which the *least* number of times?

9. Square 15, subtract 25, divide by 50, multiply by 225, take the square root, add 34, take the square root, and multiply by 250: what is the result?

10. $\frac{3}{4}$ of 7 is $\frac{3}{5}$ of how many times 3?

11. A garrison in a state of siege is put on short allowance: each man receives 12 oz. of bread, which is $\frac{4}{7}$ of a full ration, and 10 oz. of meat, which is $\frac{5}{9}$ of a full ration: find the daily rations.

12. A horse cost $1,200 and $\frac{5}{6}$ of its value is $\frac{1}{5}$ of $2\frac{1}{2}$ times the value of the farm on which it stands: find the value of the farm.

(5.)

1. A man bought a pig for £1 15s., a sheep for 15s. more than he gave for the pig, and a cow for twice as much as he paid for the sheep and pig: how much change did he receive out of a £20 note?

2. If a man take 3 steps in going 10 feet, how many would he take in going a mile?

3. Find the L. C. M. of 3, 17, 51, 102?

4. Charlie and Willie had each the same number of cents; Charlie spent 10 cents, and then they together had 70 cents: how many had each at first?

5. If A can do a work in 3 days, B in 4 days and C in 5 days, in what time could all working together do the work?

6. A has a certain amount of money, and B has $1\frac{1}{4}$ times as much, both have $180: how much has each?

7. A man owns $\frac{3}{8}$ of a ship and sells $\frac{2}{3}$ of his share for $1,275: find the value of the ship.

8. The length of a room is 18 feet 6 inches, and its breadth is 12 feet: how many yards of carpet 27 inches wide will cover the floor?

9. $\frac{7}{8}$ of 40 is $\frac{5}{12}$ of how many times $10\frac{1}{2}$?

10. A boy being asked how many cents he had, said 4 times the number is 18 less than 7 times the number how many had he?

11. If 3 pints contain 114 cubic inches, how much will be contained by a rectangular boiler 2 feet 6 inches long, 1 foot 7 inches wide, and 18 inches deep?

12. If $\frac{2}{3}$ of a yard of cloth cost 80 cents, what will $\frac{3}{4}$ of a yard cost?

13. 7 men can build a wall in 8 days of 10 hours each: in how many days of 12 hours each could they do it?

(6.)

1. Find the result of $75+85-27+12$.

2. A man undertook to split 400 rails at the rate of 1 rail in 3 minutes, agreeing to pay 5 cents for every rail he was short of the 400, he worked 10 hours and gave up: how much had he to pay?

3. A boy being asked his age replied: if you add 5 to my age, take the square root, multiply by 5, add 5, and take the square root, the result will be 5: how old was he?

4. A man bought some apples for 88 cents, at the rate of 5 for 11 cents, and divided them among his 5 children: how many did each receive?

5. A and B can together do a piece of work in $2\frac{6}{7}$ days, B can do $2\frac{1}{2}$ times as much as A in a given time: find the time required by each alone to do the work?

6. If 6 persons spend $36 in 3 days, how much will 10 persons spend in 5 days?

7. A farmer sold 12 sheep which was $\frac{3}{8}$ of $\frac{4}{9}$ of his flock: how many were in the flock after the sale?

8. $500 is to be divided between A and B so that as often as A gets a dollar, B gets $\frac{2}{3}$ of a dollar: what will each receive?

9. A quantity of sugar was sold for 12 cents per pound, the gain being $\frac{1}{5}$ of the cost price, the total gain was $3 60: find the quantity of sugar.

10. If one-third of a shilling were 6*d*., what would $\frac{2}{5}$ of £1 be?

11. $\frac{7}{8}$ of 64 is $\frac{8}{7}$ of how many times $\frac{3}{8}$ of 32?

12. A flag-staff 80 feet high was broken into two parts by the wind, it was found that $\frac{19}{25}$ of the longer part was $\frac{2}{15}$ of $9\frac{1}{2}$ times the shorter part: find the length of each part.

13. $\frac{5}{9}$ of 72 is $\frac{4}{5}$ of how many times $\frac{5}{12}$ of 60?

(7.)

1. A man bought two building lots, one for $246 and the other for $328, and sold the two for $1100: how much did he gain?

2. If a machine can cut 100 rails in a minute, how many can it cut in 10 days of 10 hours each?

3. A teacher having a school of 100 boys and 120 girls, divided the scholars into the largest possible number of classes so that each class of girls should number the same as each class of boys: find the number of classes.

4. Bought a gold chain 18 carats fine, weighing 2oz. 14dwt. 10 grains, at $24 an ounce: find the cost.

5. $\frac{6}{3}$ of 27 is $\frac{6}{9}$ of how many times $\frac{1}{10}$ of 90?

***6**. At what hour between 3 o'clock and 4 o'clock will the hour and the minute hands of a clock be together?

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* See "Examination Papers in Arithmetic," page 25.

7. A horse cost \$80, and $\frac{4}{5}$ of his cost is $\frac{1}{8}$ of four times the cost of the carriage : find the cost of the carriage

8. If the ten-cent loaf weighs 4 lbs. when flour is \$6 per barrel, what should it weigh when flour is \$7.80 per barrel?

9. A drover bought a number of sheep at \$3½ a head, and lacked \$7 of the amount required to pay for them; had he bought them at \$3¼ a head he could have paid for them and had \$3 left: how many sheep did he buy?

10. A woman gave \$1.20 to some children; each boy received 9 cents, and each girl 7 cents; there were 3 times as many girls as boys: how many were there of each class?

11. I sold a farm for \$4800 by which I incurred a loss of $\frac{1}{5}$ of what it cost me: how much did I lose?

12. If 8 men in 6 days of 10 hours each can do a certain piece of work, how many men will be required to do the work in 8 days of 7½ hours each?

(8.)

1. A boy can pick 3500 stones off a summer fallow in a day: at 20 cents a thousand, how much will he earn in a week?

2. A farmer exchanged 10 bushels of wheat at \$1.20 a bushel for 20 bushels of oats and \$3 cash: what were the oats a bushel?

3. A goldsmith manufactured 2 oz. 5 dwt. of gold into rings each weighing 9 dwts., and sold the rings at £1 4s. each: What did he receive for them?

4. A and B can together do a work in 6 days, and B can do $\frac{3}{11}$ of the work in a day and a half: how long would it take each working alone?

5. If $\frac{2}{5}$ of an inch on a county map correspond to 5 miles, what distance will represent $3\frac{3}{4}$ miles?

6. $\frac{5}{8}$ of 32 is $\frac{4}{5}$ of how many sixths of 18?

7. In a drove of 120 animals there are 50 cows and the rest are horses: how many horses must be sold that there may be left 4 horses for every 5 cows?

8. How far may a person ride in a stage which makes 6 miles an hour, so that he may drive back at the rate of 8 miles an hour, and be gone only 9 hours?

9. I sold a house for $2800, by which I gained $\frac{2}{5}$ of what it cost me: find the cost.

10. Harry is 10 years old and Mary 15 years: in how many years will Mary be 3 times as old as Harry?

11. After losses in two engagements a cavalry troop was found to consist of 950 men; in the first engagement they lost 1 in 12, in the second $\frac{5}{22}$ of the remainder: find the number of men in the troop at first.

12. In a municipality the assessment is 18 mills on the dollar: for how much is a man assessed whose taxes are $63?

(9.)

1. What number must be subtracted from 3050 to get a remainder exactly divisible by 55?

2. Hannibal won the battle of Cannæ, B.C. 216, being then 32 years of age; he was defeated at Zama, B.C. 202; he died at the age of 65: how many years before his death was the battle of Zama fought?

3. Emma bought a book and slate and a pencil for 3s. 8d.; the book and slate cost 3s. 4d.; and the slate and pencil cost 1s. 4d.: find the cost of each.

4. A man agreed to work for 30 days on the conditions that for every day he worked he should receive $1.50, but should pay 50 cents a day for his board every day he should be idle; at the end of the time he received $40: How many days did he work?

5. The dry goods in a certain store cost $1,200, and $\frac{3}{8}$ of their cost is $\frac{4}{11}$ of three times the cost of the groceries: find the cost of the groceries.

6. By selling cigars at 70 cents a dozen $\frac{3}{11}$ of their cost was gained: find the price at which each cigar should have been sold to gain $\frac{3}{5}$ of their cost.

7. A farmer sold $\frac{7}{20}$ of his farm at the rate of $40 an acre, and received $2,800 for it: what was the remainder of the farm worth at the same rate?

8. A boy said: if from the square of my age you subtract 48, $\frac{3}{11}$ of 5 times the square root of the remainder will be 15: find his age.

9. Divide $192 among Harry, John and James, so that John may have twice as much as Harry, and James 1½ times as much as John.

10. How much cloth at 5s. 3d. per yard can be bought for 21 guineas?

11. If I receive $12 for the use of $150 for 1 year, how much should I receive for the use of $375 for 18 months?

(10.)

1. Bought 26 barrels of mackerel at $8.25 a barrel, paying $100 cash, and giving my note on three months for balance: find the face of the note.

2. Find the greatest number that will exactly divide both 38 and 59, leaving 6 and 11, respectively, as remainders.

3. Two towns A and B are 45 miles apart; a person sets out from A to B at the rate of 3 miles an hour, and two hours later, another sets out from B to walk to A at the rate of $3\frac{1}{2}$ miles an hour: how far from A will they meet?

4. Simplify $\{(7^2+8^2)-2\}\times\{93+45\times3\}$.

5. Find the cost of 7,200 yards of cloth at 9s. 6d. per yard.

6. What is the length of the longest stick that will exactly measure 3 yards, 2 yards, and 9 inches?

7. How many yards of carpet 27 inches wide will be required for a room measuring 18 feet by 25 feet 6 inches?

8. Find the L. C. M. of 126, 225, 630, and 900.

9. If from a certain number 5 less than its half be taken, and from the result 4 more than $\frac{1}{3}$ (of this result) be taken, the remainder will be 22: Find the number.

10. A cistern has 3 pipes; the first alone can fill it in 12 minutes, the second in 16 minutes, and the third can empty it in 8 minutes: if the cistern is empty, and all three pipes be opened, in what time will it be filled?

11. Reduce 2[illegible] lbs. 2 ozs. to the fraction of 1 quarter, and $9\frac{1}{2}$d. to the fraction of 7s. 6d.

12. Reduce to lowest terms $\frac{55}{396}$, and $\frac{72}{1728}$.

(11.)

1. The River St. John is 450 miles long, and the Miramichi 225 miles; the sum of these lengths will give the length of the St. Lawrence, lacking 87 miles: find the length of the St. Lawrence.

2. A boy bought a lot of lead pencils for 80 cents, and sold some of them for 36 cents at 3 cents a piece, losing thereby one cent on each: for how much each must he sell the remainder to gain 4 cents on the lot?

3. A stationer sold a dozen articles for a certain price; his gain on 5 articles was his selling price for 3, and he sold 4 for 40 cents: find the whole cost.

4. Two men bought a quantity of flour for \$40, the first paying \$3 for every \$2 paid by the second; the flour was \$6 a barrel: how much will each have?

5. $\frac{7}{10}$ of the population of Dartmouth is $\frac{2}{7}$ that of Yarmouth, and the population of Yarmouth is 2,400 greater than that of Dartmouth: find the population of each.

6. Divide \$144 among A, B, C, giving A \$2 as often as B gets \$3, and C \$4.

7. Eggs are sold at the rate of 35 for 54 cents, and the gain at this rate is one-fifth of the cost: find at what rate per dozen they were purchased.

8. If an army marches 130 miles in $6\frac{1}{2}$ days of 9 hours each, how far can it march in $4\frac{1}{4}$ days of 10 hours each?

9. If a horse eats $\frac{2}{5}$ of a bushel of oats per day, how long will $5\frac{3}{5}$ bushels last him?

10. In a certain business a partner whose share is $\frac{3}{10}$ of the capital, receives \$900 of the profits: what share is owned by a partner who receives \$800 of the profits?

11. Lead weighs $11\frac{2}{5}$ times and platinum 21 times an equal bulk of water: find the weight of a piece of platinum equal to a piece of lead weighing 190 lbs.

(12.)

1. The population of Newcastle, N.B., is 2,125, and of Moncton, 2,275; find the population of St. John, which would make nine Newcastles and as many Monctons.

2. Find at \$4 a cord, the value of a pile of wood 76 feet long, and 6 feet high.

3. The expense of carpeting a room was $60 ; if the breadth had been 2 feet greater, the expense would have been $70: find the breadth of the room.

4. Charles having been asked his age replied : 5 times my age is greater, by 24 years, than three times my age : find his age.

5. The population of Woodstock (N. B.), is 2,500 and $\frac{4}{5}$, of this is $\frac{2}{3}$ of $2\frac{1}{2}$ times the population of Fredericton : find the population of this city

6. The population of Toronto is $6\frac{3}{4}$ times that of Charlottetown, and $\frac{5}{6}$ of the population of Charlottetown is greater by 1,000 than $\frac{1}{9}$ of that of Toronto : find the population of each of these cities.

7. If A and B can do a work in 3 days, B and C in 4 days, and C and A in 6 days, in what time could each by himself do it

8. A grocer mixed a quantity of sugar worth 8 cents a pound with an equal quantity worth 10 cents a pound, and sold the whole at 11 cents a pound, gaining on the whole $10 : find the quantity of each kind.

9. If a room is 12 feet wide and 15 feet long, what must be its height that the area of the walls may amount to 72 square yards ?

10. Find in dollars and cents the cost of a piece of English cotton containing 72 yards, at $5\frac{1}{2}$*d.* a yard—the shilling sterling being worth $24\frac{1}{3}$ cents

11. B can work twice as fast as A, they both can in 5 days do a work for which $20 is to be paid ; they work together 3 days and then B leaves, and A finishes the work : how should the money be divided ?

(13.)

1. What portion of 3 cwt. 14lbs. is $\frac{1}{3}$ of 1 cwt. 2 qrs. 7lbs?

2. The longitude of Halifax is 65° 4′, and that of Montreal 73° 37′: find the difference in time between these two cities, 15° making a difference of one hour.

3. What number increased by 3, multiplied by 4, 3 subtracted, and the remainder divided by 11, gives quotient three?

4. If John had as many more marbles as James, and half as many more, and 8 besides, he would have 63: how many has James?

5. A boy agreed to carry 100 glasses on the conditions that for every glass he carried without breaking, he should receive 10 cents, and pay 30 cents for every one he broke; he received $6: how many did he break?

6. A boy found a sum of money, and on giving it to the owner he received as a reward $\frac{1}{4}$ of the sum; had he received $\frac{1}{2}$ of $\frac{3}{4}$ of the sum his reward would have been 25 cents more than it was: how much did he receive?

7. A merchant sold some cloth at 87$\frac{1}{2}$ cents a yard, gaining $6; had he sold it at $1 a yard he would have gained $9: how many yards did he sell?

8. What sum of money increased by $\frac{1}{2}$ of itself, and then by $\frac{2}{3}$ of $\frac{3}{4}$ of this sum, gives $45?

9. The distance from Halifax to Shubenacadie is 40 miles. A starts to walk from the former place to the latter, and B from the latter to the former; when they meet, $\frac{3}{11}$ of the distance walked by A is found to be equal to $\frac{1}{3}$ of that travelled by B: how far had each walked?

10. Sold two horses at $200 each, on one of them gaining $\frac{1}{4}$ of what he cost, on the other *losing* $\frac{1}{4}$ of what he cost: find the net gain or loss.

11. 6 apples and 4 oranges cost 18 cents; 3 apples and 6 oranges cost 21 cents: find the cost of one of each.

(14.

1. The longitude of St. John is 66° and of Toronto 79° 25′: find the difference between St. John time and Toronto time.

2. A farmer wishes to build a board fence 270 ft. long; he has boards $13\frac{1}{2}$, 18 and $22\frac{1}{2}$ feet long resp.: what is the least number of post holes he can dig so as to leave no waste in the lumber?

3. If the population of St. Andrews is multiplied by 20, and the square root of the product is divided by 4, 7 times the quotient will be $\frac{7}{50}$ of the population of St. Stephen, which is 2500: find the population of St. Andrews.

4. If water expand $\frac{2}{25}$ of its bulk by freezing and a cubic foot of water weigh $62\frac{1}{2}$ lbs, find the weight of a cubical block of ice having a surface of 54 square feet.

5. Find the value of 27 articles at £2 3s. 4d. each.

6. What is the smallest amount of money with which I could purchase either sheep at $\$2\frac{1}{4}$ each, hogs at $\$4\frac{1}{2}$ each, or calves at $\$6\frac{3}{4}$.

7. Find the value of 440 lbs. of wheat at $1.50 per bushel.

8. A man has 5 days' statute labour to perform. Working hours from 8 a.m. to 5 p.m., 1 hour for noon. A team and plow are reckoned equal to two men and a team and scraper equal to 3 men. He commences work with his team on Monday morning, ploughs the first half day and scrapes the rest of the time. What day and at what hour will he be done?

9. Divide \$120 into 3 parts which shall be to one another as 3, 4, 5.

10. A train running at the rate of 40 miles an hour takes 45″ to cross a bridge $\frac{1}{4}$ of a mile long: find the length of the train?

11. 4 times a number is 15 less than $6\frac{1}{2}$ times the number: find it.

12. A can do a piece of work in a day, B in a day and a half, C can do twice as much work in the same time as B: how long would it take C to do a piece of work that took the other two 5 days?

(15.)

1. The population of Dalhousie is 1000, of Bathurst the same, of Newcastle, 2000, and of Chatham 2500: find the population of Montreal, which is $24\frac{8}{13}$ times the united population of these towns?

2. A boy sold a number of oranges at 2 cents each; had he charged $2\frac{1}{2}$ cents each and sold 4 more, his receipts would have been 16 cents more: how many did he sell?

3. Divide \$65 among 3 men, so that as often as the first gets $\$\frac{1}{2}$, the second shall get $\$\frac{1}{3}$, and the third $\$\frac{1}{4}$.

4. Four men started on a hunting expedition with provisions to last 10 days; before they had eaten any they were joined by 5 others who had provisions to last (the five) 6 days: if one of the second party could eat twice as much as one of the first, how long would all the provisions last the whole company?

5. Divide \$88 among 3 men, 4 women, and 5 boys, giving a man \$3 when a woman gets \$2, and a boy \$1.

6. If millers take out $\frac{1}{12}$ for toll, and a bushel of wheat produces $\frac{2}{3}$ of its weight in flour, how many bushels of wheat must be taken to the mill to receive back 220 lbs. of flour?

7. A and B can do a work in 2 days, A and C in 3 days, B and C in $2\frac{1}{2}$ days: they begin together and finish the work: how should the $6 paid for the work be divided?

8. What must a boy ask for a pair of skates that cost $1.20, that he may take $\frac{1}{3}$ off his asking price and still make a profit of $\frac{3}{4}$ of their cost?

9. When gold is at 105, what is the value of a $10 greenback?

10. A and B are 30 miles apart, and they travel to meet each other; A goes 4 miles an hour, and after he has been travelling 2 hours, B starts off and after travelling $\frac{1}{4}$ of the whole distance meets A: find B's rate per hour.

(16.)

1. A dealer bought 113 quintals of codfish at $3.65 per quintal: what did he pay for the whole?

2. My horse is worth $\frac{1}{2}$ as much again as my buggy: what fraction of the price of the horse is the buggy worth less than the horse?

3. Having laid out $\frac{1}{3}$ of my money, and lent $\frac{3}{5}$ of the remainder, I have $24 left: how much had I at first?

4. A man has to be at a railway station at a certain time; if he walk $2\frac{1}{2}$ miles an hour he will be 12 minutes too late, but if he walk 3 miles an hour he will be 12 minutes too soon: at what rate must he walk to be just in time?

5. A number which is divided into 3 parts, which are as 1, 3, 5; the second part is 24: find the number.

6. A merchant bought wheat at $1.20 a bushel by measure, and just gets his money back by selling it at $1.10 a bushel by weight: how many pounds to the bushel did the wheat over-run?

7. If to $\frac{1}{2}$ the cost of my horse you add $80, the sum will be $\frac{41}{50}$ of the cost: find it.

8. 10 square yards of cloth are required, the cloth selected is one yard wide, but when sponged will shrink $\frac{1}{10}$ in length and $\frac{1}{10}$ in width: how many yards must be purchased?

9. If 40 lbs. of sea-water contain 2 lbs. of salt, how much fresh water must be added so that 3 lbs. of the mixture may contain $1\frac{3}{5}$ ounces of salt?

10. A boy sold 2 dozen oranges, $\frac{2}{3}$ of his gain on 12 was his selling price for 4: what fraction of selling price is cost?

11. Three men or four boys can do a work in 12 days: in what time can 3 men and 4 boys do it?

12. A school is allowed $1\frac{1}{2}$ hours for dinner; a boy walks home at the rate of 4 miles an hour, takes 20 minutes to eat his dinner and is back in time, walking at the rate of 3 miles an hour: how far does he live from the school?

(17.)

1. The latitude of St. John is 45° 18′, that of Toronto, 43° 40′: allowing 70 miles for a degree, how many miles is St. John north of Toronto?

2. 5 men or 8 boys can do a work in $6\frac{2}{3}$ days: in what time will 3 men and 4 boys do $2\frac{1}{2}$ times as much?

3. A man sold a horse and gained $\frac{1}{10}$ of the selling price; if he had bought him for $12 less, he would have gained $\frac{1}{4}$ of the cost: find the cost.

4. A and B do a piece of work, A receiving $2 a day and B \$3 a day ; A works twice as many days as B, and \$70 is paid for the work : how many days did each work ?

***5**. The sides of a right angled triangle are 6 ft., 8 ft. and 10 ft. respectively : find the length of the perpendicular on the hypothenuse.

6. Find the cost of $\frac{3}{4}$ of $\frac{}{6}$ of 40 bushels of wheat at \$1.12$\frac{1}{2}$ per bushel.

7. What is the first time after 12 o'clock at which the hands of a clock form an angle of 60° ?

8. A boy being asked how much he was worth said: add \$17 to the number of dollars, take the square root, multiply by 5, add 5 to the product, extract the square root and multiply by 80$\frac{2}{5}$; the result will be 402 : how much was he worth ?

9. An agent sold \$2700 worth of goods, receiving for his trouble \$3$\frac{3}{5}$ on every \$100 : how much did he receive in all ?

10. A brakesman is noticed running in the same direction as the train, on the top of a freight train going at the rate of 10 miles an hour, and is observed to take $\frac{1}{2}$ a minute to pass 2 telegraph poles which are 20 rods apart : at what rate is the man running, independently of the train ?

(18.)

1. Bought 10 chickens at 60 cents each, 6 ducks at 50 cents each, and 4 turkeys at \$1 each, paid on account \$6.80 : how much is still due ? how many ten cent pieces will pay the balance ?

2. A teacher being asked how many scholars he had, answered that 30 of them were boys, and $\frac{4}{5}$ of them, less 20, were girls: how many scholars were there in all?

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*Note that the product of the perpendicular on the hypothenuse equals the product of the other two sides.

3. If $\frac{1}{7}$ of my age has passed since I was 36 years old, how old am I?

4. An equal number of geese, chickens and turkeys were sold for $11.40; each goose brought 60 cents, each chicken 30 cents, and each turkey $\frac{10}{9}$ of the cost of a goose and a chicken: how many fowls were sold?

5. How much water must be added to 30 gallons of brandy, at $4 a gallon, to make it worth $2.50 a gallon?

6. A man went to market and bought a turkey and a goose weighing in all 24 lbs., the goose at 8 cents a pound and the turkey at 12 cents a pound; the whole cost was 12 cents more than if he had bought both at an average price of 10 cents a pound: what was the weight of the turkey?

7. What o'clock is it if the time past 10 is $\frac{1}{3}$ of the time past 9?

8. One number is $7\frac{1}{2}$ times another: if the difference between them is 65, what are the numbers?

9. How many boxes 9 inches long, 6 inches wide and 3 inches deep, can be packed in a space 3 ft. each way?

10. A owns $\frac{3}{5}$ of a lot of land, and B the remainder. The lot is sold, A receiving $\frac{3}{5}$ of his share of the money and B $\frac{1}{5}$ of his. B afterwards received $40 from the purchaser, and the balance then due was divided equally between A and B: what was the lot sold for?

(19.)

1. A waggon is going at the rate of 8 miles in 1 hour and 20 minutes, and a buggy is coming up behind at the rate of 6 miles in half an hour. If the buggy overtakes the waggon in $1\frac{1}{4}$ hours, how far was it behind at first?

2. The product of two numbers is 48: if one of the factors is $\frac{1}{9}$ of 27, the other is $\frac{4}{7}$ of what number?

3. A and B hire a livery at Brampton, to drive 12 miles, each to pay in propórtion to the distance he rides. A calls at B's residence which is 4 miles from Brampton, and leaves him there on their return: what should each pay, if the hire of the rig cost 3 dollars?

4. A's and B's ages together are 48 years, 4 years ago B's age was $\frac{2}{3}$ of A's: required their present ages?

5. A pole is 51 feet long, is broken by the wind, $\frac{2}{3}$ of the length of the longer is equal to $\frac{3}{4}$ of the length of the shorter: find the length of each.

6. If $\frac{1}{6}$ of a piece of work can be done by three men in 2 days: how many men will it take to finish the remainder in three days?

7. What o'clock is it, if the time past 3 is $\frac{1}{3}$ of the time from now to 4?

8. Which is the cheaper, a hat that costs $1.40 and lasts 7 months, or one that costs $2.70 and lasts 9 months? What is saved in three years by wearing the cheaper hat?

9. Two blocks of wood, each 6 ft. long, contain the same number of cubic feet, the first is 2 ft. by $1\frac{1}{2}$, and the second is 9 inches one way: what are its dimensions the other?

10. The expense of carpeting a room with carpet is $20, but if it was 3 ft. wider it would cost $25: find the width of the room?

(20.)

1. A parcel of 12 lbs. weight is carried 25 miles for 30 cents, and the rate for the distance over 10 miles is $\frac{2}{3}$ of the rate for the first 10 miles : how far can a parcel of 9 lbs. be carried for 20 cents ?

2. Two hens and 3 ducks cost \$1.15 and 3 hens, and 5 ducks cost \$1.85 : how much more does a duck cost than a hen ?

3. A does $\frac{2}{3}$ of a piece of work in 4 hours, B does $\frac{3}{4}$ in an hour, and C finishes it in $\frac{1}{3}$ of an hour : how long would it have taken all working together to do the work ?

4. B travelled 102 miles in three days ; the first day he travelled $\frac{1}{2}$ as far as on the last two days, and on the last day $\frac{1}{2}$ as far as on the first two days : how far did he travel on the first day ?

5. A dishonest milkman adds a quart of water to every gallon of mile and then sells the mixture at $\frac{1}{10}$ more than it cost him : what is his profit on an expenditure of \$10 ?

6. A farmer having bought a certain number of sheep for \$100, when a dog killed 8 of them, he sold $\frac{1}{3}$ of the remainder for cost and received \$20 : how many did he buy ?

7. Two men, A and B, enter into partnership and gain \$300 ; A owns $\frac{2}{3}$ of the stock, lacking \$40, and gains \$180 ; required the whole stock and share of each ?

8. A thief has 220 yards the start of an officer, in the next half mile he gains 10 rods more, after which the officer runs 3 rods while the thief runs 2 rods : how far had each run when the thief was overtaken ?

9. One-half of the pupils in a class are girls, the other half are boys; the girls own 65 books, the boys 91, each having the same number. What is the largest number of pupils that could be in each class?

10. How many flowers can be planted along the borders of a flower bed 12 ft. long by 9 ft. wide, the flowers being 6 inches apart?

11. What is the value in cents of the largest coin with which I can pay the following three bills: 2 crowns, 1 sovereign, and 1 guinea?

END OF PART I.

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